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CRITICAL AND STRATEGIC CROPS RESEARCH

A Directory of USDA and State Projects
in CRIS

Prepared by

National Agricultural Library

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Current Research Information System
Cooperative State Research Service

U.S. DEPARTMENT OF AGRICULTURE

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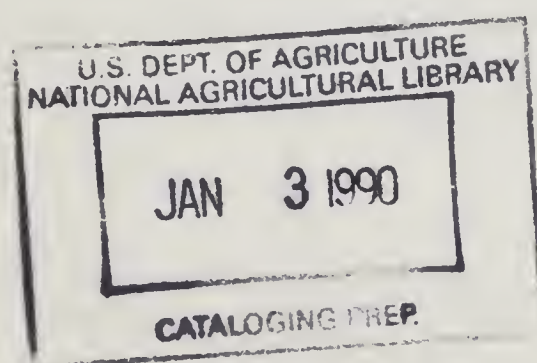
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PREFACE

In May, 1984, the passage of the Critical Agricultural Materials Act, P.L. 98-284, set the stage for defining the role of agriculture in providing materials for the Nation's industries. It restates the national policy for the production of critical agricultural materials to benefit the Nation and promote economic development.

Critical materials are those which are in demand by industry and have a high reliance on foreign sources. These materials may or may not be strategic. If agriculture can support the industrial base by production of raw materials, it will play an important role in filling the Nation's strategic needs.

This directory focuses on 11 crops that potentially can provide substitutes for petroleum and other imported agricultural materials used by industry.

The Current Research Information System (CRIS) is the source for all projects listed in this directory. CRIS is a computerized information storage and retrieval system which serves as the USDA - State documentation and reporting system for publicly supported agricultural and forestry research in the U.S. CRIS is operated by the Cooperative State Research Service, USDA. Projects were selected from the CRIS online file dated January, 1986.

Full project abstracts appear in this directory in the main entry section titled Research Project Descriptions. Projects in this section are listed in chapters alphabetically according to crop, except for the last chapter which consists of four crops. In instances where a project covers more than one crop category, the same project is repeated in other applicable chapters. Repeat entries are identified by an asterisk in both the main entry section and indexes.

Arrangement of projects within chapters is alphabetical by state or country, followed in order by name of performing institution, department, and investigator.

Three indexes offer additional points for locating projects in the directory; namely, the Keyword/Title Index, Investigator Index, and Performing Institution Index. The two left-most digits indicate the chapter in which the project is located. The three right-most digits indicate the position within the chapter.

Index terms appearing in the Keyword/Title index are the single or multiple-word terms assigned to the projects by CRIS primarily for use in computer retrieval. Project titles are inserted to provide context.

The Investigator Index is an alphabetical listing of principal and co-investigators cited on the projects.

The Performing Institution Index lists the names of the institutions alphabetically by city within state or country.

This directory was compiled by Jerome Rafats, Economics and Marketing Reference Branch, National Agricultural Library, and F. Allen Moore, Current Research Information System, with assistance of Philip L. Dopkowski, Current Research Information System, Edward Warnick, Information Systems Division, National Agricultural Library, and Douglas Stein, Office of Critical Materials, U.S. Department of Agriculture.

Copies of this Directory are available by sending a return-addressed mailing label to:

J. Rafats, E&M, Room 111
National Agricultural Library
Beltsville, MD 20705

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RESEARCH PROJECT DESCRIPTIONS

COM 01 CRAMBE

01.001 CRIS0081673
DEVELOPMENT OF NEW AND IMPROVED CROPS FOR WATER
CONSERVATION IN ARID LANDS

RAINS D W; Agronomy & Range Science;
University of California, Davis, CALIFORNIA
95616.
Proj. No.: CA-D*-ARS-3983-RR Project Type: HATCH
Agency ID: CSRS Period: 01 OCT 79 to 30 SEP 86

Objectives: Evaluate species of Curciferae which will produce useful products under minimum water regimes and develop effective production practices for such species. Breed improved cultivars of guayule (*Parthenium argentatum*) having a high rubber content (15-20%) and develop economical cultural and harvesting procedures with emphasis on growing guayule under minimum water regimes.

Approach: Cruciferous species: Evaluate superior introductions of cruciferous species including *Brassica campestris*, *B. napus*, *B. juncea*, *B. carinata*, *B. nigra*, *B. hirta*, *Crambe abyssinica* and *Eruca sativa* for yield, seed oil content, fatty acid composition of the oil, other plant characters and resistance to pests. Conduct tests of fertilizers, herbicides and rates and dates of seeding. Initiate a breeding program to develop better adapted genotypes. Guayule: Test strains, herbicides, fertilizer treatments and irrigation treatments. Initiate a breeding program.

Progress: 84/01 to 84/12. Brassica species. Twenty one lines of *B. juncea* and *B. carinata* were released for distribution to breeders and geneticists. Disease free lines will be maintained by the Dept. of Plant Pathology, University of Wisconsin (Paul Williams). Four rep yields tests were planted at two sites in Yolo county; primarily of advanced lines of *B. campestris* but also including *B. juncea* and *B. nigra*. *B. campestris* lines will also be evaluated spring planted in Saskatoon. Lupinus species. Cooperative extension trials of sweet cultivars of *L. albus* were planted at 12 locations in seven counties; primarily for seed production but also for forage mix provided for cooperative research with Environmental Toxicology on alkaloid metabolism in dairy cows (Crosby) and one ton lots of 1985 harvested seeds will be given to Avian Sciences for poultry feeding studies (Vohra). Seed was provided for N(2) fixation and cultural practices studies at UC Davis (Cassman). Evaluation of lupine diseases at all locations will begin this Spring (Buddenhagen).

Publications: 84/01 to 84/12
COHEN, D.B. and KNOWLES, P.F. 1984. Release of *Brassica* germplasm from UC Davis. *Crucifer Genetics Newsletter*, Fall.

01.002 CRIS0072758
DEVELOPMENT OF ALTERNATIVE CROPS FOR NORTHERN IDAHO

AULD D L; MURRAY G; Plant & Soil Sciences;
University of Idaho, Moscow, IDAHO 83843.
Proj. No.: IDA00737 Project Type: HATCH
Agency ID: CSRS Period: 01 JUL 77 to 30 JUN 84

Objectives: Determine the potential adaptation of several crop species to the climate and agricultural requirements of northern Idaho. Develop pest management and cultural practices as well as locate high yielding varieties of crops adapted to northern Idaho. In cooperation with commodity commissions and the Department of Agricultural Economics, locate and determine marketing potential for adapted crops while evaluating the economic feasibility of producing these crops in northern Idaho.

Approach: Alternate crop species will be screened for adaptation in replicated trials conducted at several locations in northern Idaho. Those crops with demonstrated potential for production will be subjected to variety testing and evaluation for weed control, insect control, soil fertility, and crop management practices. Proposed research will attempt to develop a total crop management program for each crop. Simultaneous cooperative projects with commodity commissions and agricultural economists will attempt to locate and develop both domestic and export markets. The production costs of these crops will be estimated and compared with existing crops to determine the economic competitiveness of alternate crop production.

Progress: 83/01 to 83/12. Five plants from 202 selected F(4) families of winter rape were selected for low levels of glucosinolate. Selection gains for increased oleic acid (18:1) were 94.6 and 61.7% in two crosses. Selection gain for increased erucic acid (22:1) was 131.1% in the 'Norde' X 'Indore' cross compared to only 67.2 and 79.0% when Indore was crossed to WW827 and Sipal, respectively. Selection for an improved fuel value index was not successful. Five breeding lines and three cultivars of Crambe produced from 1810 to 2500 kg/ha of seed. None of the entries differed in seed yield, glucosinolate content, or fatty acid composition. The buckwheat cultivars 'Mancan,' 'Manor,' and 'Royal' produced 1900, 1900, and 2130 kg/ha of seed, respectively. Planting these cultivars on May 17, May 27, and June 6 produced 2090, 1770, and 1320 kg of seed per acre, respectively. The buckwheat cultivars did not respond to nitrogen fertilization. Two lines of chickpeas were released by the Foundation Seed Stocks Committee. 'Lyons,' a small seeded Kabuli type is a local landrace while '85-21' is a small dark brown desi introduced from India as a breeding line. Desi

chickpeas 85-21 and C-235 averaged 1920, 1744, and 1778 kg ha on 8.8, 17.5, and 30 cm row spacings, respectively, at Moscow. Seed yield increased from 1279 to 2280 kg ha as population within a row increased from 6.6 to 19.8 seed m². Similar results were obtained at Grangeville.

Publications: 83/01 to 83/12

- THOMAS, V.M., KATZ, R.J., AULD, D.L., PETERSON, C.F. and STEELE, E.E. 1983. Nutritional value of expeller extracted rape and safflower oilseed meals for poultry. *Poultry Sci.* 62:882-886.
- PETERSON, C.L., WAGNER, G.L. and AULD, D.L. 1983. Vegetable oil substitutes for fuel. *Trans. of Amer. Soc. of Agric. Engr.* Vol. 26:322-327.
- PETERSON, C.L., AULD, D.L. and THOMPSON, J.C. 1983. Experiments with vegetable oil expression. *Trans. ASAE* 26:1298-1302.
- AULD, D.L., ULLRICH, S.E. and BETTIS, B.L. 1983. Screening safflower for winterhardiness in the Palouse region of eastern Washington and northern Idaho. *Idaho Agr. Expt. Sta. Prog. Rept.* 225.

01.003 CRIS0044718
ISOLATION AND IDENTIFICATION OF ALLELOCHEMICALS FROM UNCULTIVATED PLANTS

KLEIMAN R; SPENCER G F; WOLF R B; Northern Regional Res Center, Peoria, **ILLINOIS** 61604.
 Proj. No.: 3620-20160-009-00D

Project Type: INHOUSE

Agency ID: ARS Period: 02 OCT 78 to 16 APR 87

Objectives: Detection and identification of phytochemical agents potentially useful in weed control and plant growth regulation.

Approach: Screen for useful biological activity such as bioregulation in extracts from seed and other plant parts. Activity will be measured by relative germination rates of selected weed seeds. Active principles will be isolated and characterized by chromatographic and spectroscopic means.

Progress: 83/01 to 83/12. The biological screening of extracts from seed of 225 wild species revealed germination inhibitors in 21 of them. Selections from this group will be made for isolation and characterization of active compounds. Benzyl isothiocyanate, an active germination inhibitor of velvetleaf seed at the 4×10^{-5} M level did not affect corn even at moderately high concentrations such as 10^{-4} M but did affect soybean at the 10^{-5} level. Soybeans were not affected at the 4×10^{-5} M level. The acetone extract of defatted *Iva axillaris* seeds was found to contain germination inhibitors tomentosin and ilicic acid. Other compounds, such as avivalin, had growth inhibitory properties. This work also resulted in the isolation a new sesquiterpene, tentatively identified as the isovalerate ester of ivaxillarin. Computer programs were written and data entered in order to have searchable files for future reference of germination inhibition data. In cooperation with plant breeders working in the new crop area, analyses

for oil, protein, and fatty acids of seed were accomplished. Species included in this program were rape, crambe, *Sapium*, *Sebiferum*, *Cuphea*, and *Vernonia*.

Publications: 83/01 to 83/12

- ABBOTT, T.P., JAMES, C., and PLATTNER, R.D. 1983. Products of wheat straw biodegradation by *Cyathus stercoreus*. *ACS Symp. Ser. No. 214, Unconventional Sources of Dietary fiber*, I. Furda, ed., Chap. 19, pp. 267-284.
- AWL, R.A., FRANKEL, E.N., and TJARKS, L.W. Cyclic fatty esters: Stereochemistry of monounsaturated products from the hydrogenation and reduction of 9-(6-propyl-3-cyclohexenyl)-8-nonenoic acid or ester. *Chem. Phys. Lipid.*
- CARLSON, K.D., CUNNINGHAM, R.L., and HERMAN, I.A. 1983. Sweet sorghum grown on sludge-amended stripmine soil: A preliminary look at yields, composition, and ethanol production. *Trans. Ill. State Acad. Sci.* 76:111-122.
- CULL, I.M. 1983. Midwest plants for potential crops. *Trans. Ill. State Acad. Sci.* 76:213-216.
- GARCIA, W.J., CAVINS, J.F., INGLET, G.E., HEAGLE, A.S., and KWOLEK, W.F. 1983. Quality of corn grain from plants exposed to chronic levels of ozone. *Cereal Chem.* 60(5):388-391.

01.004 CRIS0044659
INTRODUCTION, EVALUATION, AND PRESERVATION OF NEW CROP SPECIES--NORTH-CENTRAL-REGION

CLARK R L; ROATH W W; Plant Introduction Res; Agricultural Research Service, Ames, **IOWA** 50010.
 Proj. No.: 3808-20160-006-00D

Project Type: INHOUSE

Agency ID: ARS Period: 17 JUL 78 to 30 MAR 85

Objectives: Through evaluation and research for adaptability and cultural requirements, gain new and improved knowledge of the chemical, biological, and agronomic potentials of selected industrial oils, waxes, gums, fibers, of food and feed proteins, and licit and illicit drugs and other medicinals, with emphasis on plants of current interest. Increase seed for distribution for use in experimental plantings and for preservation of germplasm collections.

Approach: Plant materials will be obtained through exploration and introduced for both chemical and cultural evaluation in the search for food, feed, and industrial end-uses which would be the basis for new or replacement crops for the United States. The work may involve cooperation between the Northern Regional Research Center, the State Experiment Stations, and other research institutions in the regions, both as to chemical and cultural problems.

Progress: 82/01 to 82/12. Techniques for increasing Brassica that would improve seed production and minimize outcrossing are being tested. Several accessions of *B. napus* were grown in cages in 1982 with encouraging results

as to seed production. More work will be continued under cages in 1983. P.F. Knowles, U.C. Davis, contributed more than 1500 accessions of Brassica to NC-7 over a period of years. In 1982 we sent 64 pounds of *Berteroa incana* seed to the Northern Regional Research Center, Peoria, IL as part of the cooperative work with the Center.

Publications: 82/01 to 82/12

NO PUBLICATIONS REPORTED THIS PERIOD.

01.005 CRIS0094672
AGRONOMIC DEVELOPMENT OF CRAMBE IN IOWA

WOOLLEY D G; Agronomy; Iowa State University, Ames, IOWA 50011.
Proj. No.: IDW02714 Project Type: STATE
Agency ID: SAES Period: 01 OCT 84 to 01 JAN 87

Objectives: To evaluate the agronomic suitability of Crambe to Iowa's environment and production systems. To determine the essential management practices to insure profitability. To determine the effects of environmental management practices on the production and quality of extractable oil and seed meal.

Approach: Experiments comparing various seeding rates, row widths, dates of planting, cultivars, weed control systems, and harvesting methods will be developed at the Agronomy and Ag. Engineering Research Center during the next two cropping seasons, 1985 and 1986. Greenhouse and growth chamber studies will involve such variables as temperature, light, moisture, and seed treatment. The effect of the various cultural practices on seed-oil content will also be determined as facilities and funds permit.

01.006 CRIS0047896
PRODUCTION PROBLEMS OF THE OILSEED CROP, CRAMBE (CRAMBE ABYSSINICA)

CARLSON K D; BEATTY D; Department of Agriculture; Murray State University, Murray, KENTUCKY 42071.
Proj. No.: 3620-20560-009-01S
Project Type: COOPERATIVE AGREE.
Agency ID: ARS Period: 31 AUG 82 to 30 JUN 85

Objectives: Develop knowledge of production and storage of crambe seed to allow probable economic production of this high-erucic acid oil source in agriculturally depressed western Kentucky; to increase supply of viable seed for future use.

Approach: Investigate effects of cultural practices on the production of high-erucic Crambe abyssinica seed, such as land preparation, planting date, climate and soil conditions. Compare the effectiveness of several herbicide regimes for weed control; compare extent of insect problems in several fields and the effectiveness of insecticidal treatments. Investigate the effect of

transportation and storage on seed; study seed cleaning; and ascertain safe moisture levels during storage. Investigate the microflora associated with the seed and determine seed viability by appropriate germination tests over a period of time in storage.

Progress: 83/01 to 83/12. Three 10-acre fields of crambe were planted in Kentucky under the auspices of a cooperative agreement with Murray State University, Murray, Kentucky. Two fields planted early and subjected to a cold, wet spring, were harvested and placed in storage. The third field, planted in June, was lost to very hot, dry summer weather (seed pods were mostly empty due to poor seed set). Seed from these fields and replicated plots at Murray are being evaluated and seed composition determined. Weed control in all three production fields was satisfactory using no herbicide in one and either Basalin or Ramrod in the other fields. Fungicide trials were superimposed on the seed production fields using multiple applications of Maneb, Mancozeb, or Daconil. A consistent yield response from fungicide treatment was not observed in these tests, because hot, dry weather resulted in lower than normal incidence of *Alternaria* infection. In a pilot study on the effects of fungicides in the control of *Alternaria* disease, two spray rates each of Benlate and Daconil were tested on crambe plots during flowering and early seed-set. Seed weights were not significantly different, but seeds from plants receiving the high Daconil rate (2 pt/acre) had greater germination rates and seedling vigor, and lower incidence of *Alternaria* infection in the seedlings. Nitrogen applications increased seed weight and yields when applied at >60 lb/acre, but oil content of the seed and erucic acid levels in the oil were unaffected.

Publications: 83/01 to 83/12

PALMER, J.J. 1983. The effects of nitrogen applications on yield and oil characteristics of Crambe abyssinica (Hockst. ex. R. E. Fries) grown in western Kentucky. M.S. Thesis. Murray State University, Murray, Kentucky.

01.007 CRIS0082026
INVESTIGATION OF NEW CROPS FOR NEVADA

GILBERT D E; JENSEN E H; LEEDY C D; Plant Soil & Water Science; University of Nevada, Reno, NEVADA 89557.
Proj. No.: NEV00486 Project Type: STATE
Agency ID: SAES Period: 01 JUL 80 to 30 JUN 83

Objectives: Evaluation of plant species identified and suggested as potential new crops for Nevada, selection of most promising species for field testing and economic assessment and collection and evaluation of available information about these species.

Approach: Review literature and match crop requirements with climate and soil conditions based upon area analogs. Plant field trials no larger than 0.25 acre of selected crops and evaluate for production potential. Review

literature for exotic species from analogous areas and plant field trials no larger than 0.25 acre for evaluation. For those species which pass screening tests, initiate programs of seeding dates, rates, fertilizers, irrigation, weed control, harvesting and economic assessment.

Progress: 83/01 to 83/06. Plantings of gopher weed (*Euphorbia lathyris*) at Reno and Austin failed to survive through the first winter. In the milder climate at Fallon the plant survived but latex production was insufficient to hold much prospect for petroleum fuel substitution. Observations revealed that sufficient wild germplasm exists to indicate the plant can grow in areas of 130 day growing season; pathological activity of the wild seed source was excessive in that the plant is a prolific seed producer under the cool temperatures of desert night. Investigations with meadowfoam (*Limnathes alba*) and crambe (*Crambe abyssinica*) revealed that meadowfoam will not perform under our dry conditions. Crambe may produce if handled as a winter annual.

Publications: 83/01 to 83/06
NO PUBLICATIONS REPORTED THIS PERIOD.

01.008 CRIS0030039
**ADAPTATION AND CULTURAL PRACTICES FOR
NONTRADITIONAL CROPS WITH POTENTIAL FOR THE
HIGH PLAINS OF MEXICO**

FINKNER R E; Agri Science Center At Clovis; New Mexico State University, Las Cruces, **NEW MEXICO** 88003.
Proj. No.: NM-1-3-42143 Project Type: STATE
Agency ID: SAES Period: 01 JAN 85 to 30 JUN 89

Objectives: Determine high yielding, well adapted cultivars of several nontraditional crops, i.e., soybeans, sunflowers, onions for seed, crambe, rapeseed, Jerusalem artichokes, guayule, grapes, chick-peas, pearl millet, buffalo gourds, and other minor crops which may have potential value for the High Plains area of New Mexico. Study the effects of varying cultural practices on yield and quality of the species and cultivars under study. Investigate problems which develop, relating to the adaptation and production of nontraditional crops.

Approach: Replicated field tests and lab analyses will be used to determine the highest yielding and the best quality cultivars and the most productive cultural practices.

Progress: 84/01 to 84/12. Field tests were conducted on various crops for yield and quality. Thirty grain corn hybrids produced an average yield of 10,111 kg/ha. The average yield of ten forage corn hybrids was 8.02 T/ha of dry matter. Sixteen soybean cultivars had an average grain yield of 2940 kg/ha. Ten sunflower hybrids were yield tested under dryland and full irrigated conditions. Dryland yields averaged 2191 kg/ha with a 45.2 percent oil. The dryland test was furrow diked and a total of 41.35 cm of moisture fell with no

runoff. Yield of the irrigated hybrids only averaged 1544 kg/ha with a 44.9 percent oil. The test was irrigated twice. This year, furrow diking was more effective than irrigating in producing high yields.

Publications: 84/01 to 84/12
FINKNER, R.E. April 1984. Soybean variety trials on the High Plains of eastern New Mexico, 1978 through 1983. NMSU Agri. Exp. Sta. Res. Rep. 536.
FINKNER, R.E. May 1984. Response of pinto bean varieties to date of planting on the eastern High Plains. NMSU Agri. Exp. Sta. Res. Rep. 541.

01.009 CRIS0093647
**ALTERNATE ENERGY PRODUCTION FOR THE EAST
CENTRAL PLAINS**

MORIN G; FINKNER R E; Agriculture Science Center; New Mexico State University, Las Cruces, **NEW MEXICO** 88003.
Proj. No.: NM-1-3-42416 Project Type: STATE
Agency ID: SAES Period: 01 JUL 83 to 30 JUN 88

Objectives: Compare potential nontraditional fuel alcohol feedstocks for the east central plains with traditional feedstocks (grass). Compare nontraditional vegetable oil feedstocks for the east central plains with traditional feedstocks (sunflowers and soybeans). Evaluate the feasibility of non-farm production of electricity from wind for east central plains.

Approach: Field trials growing Jerusalem artichokes, sweet sorghum, buffalo gourds will be compared to wheat and corn trials. Harvested produce will be processed through the pilot alcohol plant. Field trials growing buffalo gourds under fertilizer and water treatments will be compared to traditional oil crops management. Data from wind design will be collected and economic of operations evaluated.

Progress: 84/01 to 84/12. Several different feedstocks were tried in the ethanol fuel alcohol pilot plant including wheat, grain sorghum, tobacco and micronized grain sorghum. Different grind sizes were tested and, in general, the finer the particle size, the greater the alcohol yield. The pilot plant was remodeled and a stripper column was added. Investigations continued on precook processing of fleshy material, i.e., potatoes, sugar beet roots, buffalo gourd roots, and Jerusalem artichokes. Crambe and rapeseed, potential fuel oil crops, were yield tested. Three different seeding rates (2.2, 2.5 and 2.7 kg/ha) of crambe were tested under irrigated and dryland conditions. No significant differences (5% level) were detected among the seeding rates. Average irrigated yield was 1159 kg/ha dryland was 1033 kg/ha. The average oil content was 21.3 percent. Two different rapeseed cultivars (regent and Tower) were tested under dryland and irrigated conditions. No significant yield differences (5%) were detected between the two cultivars. The dryland test, with 321 mm of rainfall, yielded more than the irrigated test (1567 kg/ha vs 1156 kg/ha). Oil content of the rapeseed averaged 37.6 percent. Dryland test

areas were furrow diked so no runoff occurred. Eleven cultivars of Jerusalem artichokes were yield tested under dryland and irrigated conditions. Average dryland yield was 26 T/ha with a 21.9 percent Brix. Average of the irrigated tests was 40 T/ha with a 19.5 percent Brix.

Publications: 84/01 to 84/12

NO PUBLICATIONS REPORTED THIS PERIOD.

01.010 CRIS0092535
**INTRODUCTION AND EVALUATION OF POTENTIAL
 ALTERNATIVE CROPS FOR NEW MEXICO AGRICULTURE**

LESSMAN K J; Crop & Soil Sciences; New Mexico State University, Las Cruces, **NEW MEXICO** 88003.

Proj. No.: NM-1-5-27432 Project Type: HATCH
 Agency ID: CSRS Period: 01 MAR 84 to 30 SEP 88

Objectives: To introduce potential new field crops which will produce useful products particularly for industrial applications; To evaluate the breeding potential of introduced new crop species; To breed for improved cultivars of introduced species after evaluation of breeding potential and determine the feasibility of Crambe spp. x Brassica spp. crosses.

Approach: Initial field and laboratory evaluations of Brassica spp., Crambe spp., Lesquerella spp., Amaranthus spp., Chenopodium spp., and Salsola spp. will be conducted over a three-year period. Characters studied for all materials will be seed germination, oil content, and glucosinolate content of seed meal will be studied for the Cruciferae spp. Heritability of all characters will be determined and expected gains from selection computed. Herbicides will be applied.

Progress: 84/01 to 84/12. Field evaluations of Crambe abyssinica, Brassica spp. (rape) Amaranthus spp. and Curcubita sp. (Buffalo gourd) were initiated during 1984. A replicated test nursery containing 100 crambe selections was seeded February 15. Data are being obtained for stand, seedling vigor, bloom time, height, yield, and oil production. Herbicides were applied to the crambe cultivar Meyer. The nursery area was essentially weed free and no damage was noted after dacthal (11.2 kgs/ha), treflan, and surflan (.5 kg/ha) were applied. The observation nursery containing amaranthus spp. showed shape considerable variation for inflorescence size shape color and grain yield. Selections for testing in 1985 were made. Of the eight Brassica lines evaluated, only four produced seed. Two populations 225,000 and 450,000 plants/ha of Buffalo gourd were seeded May 15 using two fertility levels in a split plot design with levels of fertility as the whole plot having five replicates. Data for gourd-seed and root-production will be obtained. Seeds and oil-free meal of Crambe abyssinica, seeds and ground seed of Sinapsis alba, seeds of Brassica juncea and seeds of Brassica napus were subjected to gamma irradiation (6.25, 12.5, 25.0 and 50.4 Mrad) to explore using irradiation to inactivate

thioglucosidase and/or glucosinolate destruction. Exposure of 50.4 Mrad does inactivate thioglucosidase but has little affect on glucosinolates.

Publications: 84/01 to 84/12

KNOWLES, P.F. and LESSMAN, K.J. 1984.

Development of new crops. CAST Rpt. 102.

LESSMAN, K.J. and MCCASLIN, B. 1984.

Feasibility of using gamma irradiation to inactivate thioglucosidase from Cruciferae. Los Alamos Biotech. Conference. Oct. 15.

01.011 CRIS0067834
MISCELLANEOUS, OIL AND SPECIALTY CROPS

HOAG B K; THOMPSON C R; Minot N Central Agr Exp Station, Minot, **NORTH DAKOTA** 58701.

Proj. No.: ND06347 Project Type: STATE
 Agency ID: SAES Period: 01 JUL 75 to 30 SEP 85

Objectives: Determine production and adaptability of new oil and other specialty crops in north central North Dakota.

Approach: The station will evaluate and compare oil crops and other specialty crops with small research plots. Data will be collected and reported on yield, test weight, adaptability, plant height, oil content, and other necessary measurements.

Progress: 84/01 to 84/12. Thirteen safflower varieties were planted at Minot, May 21 and three at off station sites at Rugby and Rolette on May 14. The soil types were Williams loam, Gardena silty loam and Tonka with hamerly loam. The average yield and (top variety) at Minot were 2370 (S-541--2779); at Rugby 3463 (S-208--2619) and Rolette 2737 (S-208-2909) kg/ha. Seven rape varieties were planted May 21 on recrop at Minot, ND. The average yield of type and (Variety) are given in kg/ha. Argentine - 990 (Westar--1126); Polish - 1004 (Tobin--1133). Sixteen mustard varieties were planted May 21 on recrop at Minot, ND. The average yield of type and (variety) are given in kg/ha. Yellow - 1004 (Tileny--1090); Brown - 1484 (BJ 1380-1454--1691); Oriental - 1657 (BJ08-1418--1918). Oil type sunflower trial at Minot, Stanley and Washburn were planted May 29, June 11, June 16, respectively on recrop land. Average yield and (top variety) are in kg/ha. Minot - 1650 (Cenex 7101--2388); Stanley - 1664 (Sokota 2057--2153); Washburn - 1665 (Interstate 7111--2134). Thirteen triticale varieties were planted May 11 on fallow at Minot. The average and (top yielder) are as follows: 2308 kg/ha (Topo--2748).

Publications: 84/01 to 84/12

NO PUBLICATIONS REPORTED THIS PERIOD.

O1.012 CRIS0046336
INDUSTRIAL OILSEED CROPS AS A SUBSTITUTE CROP
FOR OPIUM POPPY

ISARA S; GENTNER W; Agronomy; Kasetsart
University, Bangkok. THAILAND
Proj. No.: 0717-20160-024-C

Project Type: CONTRACT
Agency ID: ARS Period: 06 JUN 80 to 06 JUN 83

Objectives: Plan and conduct research on the development of oilseed crops as a source of erucic acid for industrial utilization.

Approach: Introduce germplasm of *Crambe abyssinica*, *Brassica chinensis*, *B. campestris*, *B. carinata* and *Sinapis alba* that are high in erucic acid content of the vegetable oil. Evaluate these plant adaptation, productivity, vigor and other desirable agronomic characteristics. Design experiments for intensive evaluation of the more promising source of germplasm in replicated trials. Determine the cultural requirements of the more promising lines. Determine the cultural requirements of the more promising lines. Determine oil content of seed and fatty acid analysis of oil concurrently with varieties and cultural trials.

Progress: 81/07 to 81/12. *Crambe* seed were planted 30, 50, and 70 cm rowspacing at 11 seeding rates from 5.7 to 33 kg/ha. All plants bloomed within 60 to 70 days. Seeds were drilled in 50 cm rows on July 8, August 2, September 7, and October 5. Generally, *Crambe* yielded 1,069 kg/ha containing 28.9 percent oil. Specific analyses are pending. *Linott*, *Wishek*, and *Dufferin* varieties of linseed were planted 15, 30, and 45 cm between rows. Times of emergence were 3-6 days; flowering 48 to 52 days; and height at flowering 73 to 81 cm. Varieties were planted at four densities. Specific data not available. Six varieties of linseed planted July 8, August 2, September 7, and October 5. Specific data not available at time of report. Fourteen varieties linseed planted for yield, percentage of oil, and fatty acid composition. Data for 1982 not available at this time. Data for 1980 show *Linott* had highest yield (1,253 kg/ha) and *Raja* had lowest yield (850 kg/ha). All varieties had a range from 33.5 to 31 percent oil. *Linott* had 8.7 and *Raja* had 11.4 percent total saturated oil. Total unsaturated fatty acid contents were 91.2 and 88.6 percent. Saturated fatty acids measured were palmitic and stearic. Unsaturated fatty acids measured were oleic, linoleic, erucic, and linolenic acids. *Raja*, *Culbert*, *Wishek*, and *Linott* have good quality for drying oil, while *Norred* and *Dufferin* are marginal and should not be discarded. Planting date, seeding rate and rowspacing, fertilizer, and oil analyses will be.

Publications: 81/07 to 81/12
NO PUBLICATIONS REPORTED THIS PERIOD.

02.001 CRIS0048388
GERMPLASM DEVELOPMENT AND DOMESTICATION OF CUPHEA SPECIES

THOMPSON A E; Agricultural Research Service,
 Phoenix, ARIZONA 85040.
 Proj. No.: 5422-20160-002-00D
 Project Type: INHOUSE
 Agency ID: ARS Period: 24 MAY 83 to 01 OCT 84

Objectives: Develop improved germplasm and achieve domestication of Cuphea species as new oilseed crop serving as domestic source of lauric acid and other medium chain triglycerides. Special emphasis on evaluating and developing germplasm adapted to arid regions.

Approach: Assemble, multiply, maintain complete working germplasm collection of Cuphea species. Thoroughly evaluate germplasm for agronomic characters, mode of reproduction, seed yield and quality, and adaptation to semiarid and arid climatic conditions. Determine intra- and interspecific breeding and genetic behavior. Utilize existing or develop new breeding and selection methodology to obtain rapid genetic advance and develop improved, adapted germplasm capable of commercial production. Publicly release advanced germplasm and cooperatively develop appropriate crop production systems.

Progress: 83/05 to 84/09. Research of evaluation of Cuphea germplasm has been initiated. The Cuphea germplasm working collection includes 264 accessions of 58 species from 9 of the 12 sections of the genus. Initial attempts have been made to effect interspecific hybridization as a means of releasing new sources of genetic variability to remove constraints to domestication and commercial production. Cooperative agreements have been made with scientists at State Agriculture Experiment Stations of Arizona, Oregon State and Purdue universities to support research on cytogenetics, breeding and selection, development of cultural and management methods, and tissue culture methodology for Cuphea species. Research on Cuphea will continue under a new, more inclusive project with increased funding for joint federal-state-industry multidisciplinary participation.

Publications: 83/05 to 84/09
 THOMPSON, A.E. 1984. Cuphea - A potential new crop. Hort Science 19:352-354.

02.002 CRIS0049443
GERMPLASM DEVELOPMENT AND DOMESTICATION OF CUPHEA AND OTHER NEW CROP SPECIES

THOMPSON A E; Arid Zone Crop Prod Res U. S. Water Conservation Lab; Agricultural Research Service, Phoenix, ARIZONA 85040.
 Proj. No.: 5422-20160-004-00D
 Project Type: INHOUSE
 Agency ID: ARS Period: 01 OCT 84 to 30 SEP 89

Objectives: Evaluate and develop improved germplasm and achieve domestication of Cuphea species as new oilseed crop serving as domestic

source of lauric acid and other medium chain triglycerides. Evaluate Lesquerella species and other taxa for possibility of developing new crops for arid lands.

Approach: Assemble, multiply, maintain working germplasm collection of Cuphea, Lesquerella, and other potentially useful species. Evaluate germplasm for agronomic characters, mode of reproduction, seed yield and quality, and adaptation to arid climatic conditions. Determine intra- and interspecific breeding and genetic behavior. Utilize existing or develop new breeding and selection methodology to obtain rapid genetic advance and develop improved, adapted germplasm capable of commercial production. Cooperate in joint Federal-State-Industry funded multidisciplinary research at Oregon State AES to develop Cuphea as a new domestic crop.

02.003 CRIS0081511
DISEASES OF "NEW CROPS" WITH EMPHASIS ON GUAR AND GUAYULE

ALCORN S M; Plant Pathology; University of Arizona, Tucson, ARIZONA 85721.
 Proj. No.: ARZT-173666-H-05-24
 Project Type: HATCH
 Agency ID: CSRS Period: 01 OCT 83 to 30 SEP 86

Objectives: To determine the environmental-cultural factors which favor the epidemiologies of important pathogens and the expression of symptoms by hosts; to develop control procedures.

Approach: Twenty four a will be accomplished by determining causes of diseases of various aged guayules growing in various areas under varying irrigation regimes and from greenhouse-growth chamber studies.

Progress: 84/01 to 84/12. *Tilletia cuneatum* has been identified as causing a flower smut in experimental plantings of *Grindelia camporum*. The smut appears to have been introduced via seeds collected from *Grindelia* plants growing in the wild in California. Dying plants of *Cucurbita digitata* (in experimental plantings) had rotting roots from which pectolytic bacteria and *Rhizoctonia* spp. have been isolated. Koch's postulate studies are in progress. Experimental field plantings of Cuphea Wrightii and C. toluicana were evidencing damping-off symptoms. Associated with stem and/or root lesions were *Fusarium* spp., *Rhizoctonia* spp., a *Pythium* spp., and several other fungi probably in the *Phythiaceae*. *Euphorbia lathyris* direct seeded in the field in October can be infected by *Macrophomina phaseolina* by January but remain symptomless until the following summer. In 1983 1.27% of 550 saguaros in 60 acres of plots died from bacterial necrosis; 2.73% were lost from all causes. Since approximately 1941, approximately 67.6% of all saguaros (including new plants occurring since 1941) in these plots no longer survive. Of those lost, 85.3% (977 plants; 57.6% of all plants) had symptoms of bacterial

necrosis. For information on guayule see 80-CRSE-2-0637 and 84-CRSE-2-2366 and on jojoba see SRZT-174112-H-05-303.

Publications: 84/01 to 84/12

- MIHAIL, J.D. and ALCORN, S.M. 1984. Effects of soil solarization on *Macrophomina phaseolina* and *Sclerotium rolfsii*. Pl. Dis. 68:156-159.
- YOUNG, D.J. and ALCORN, S.M. 1984. Latent infection of *Euphorbia lathyris* and weeds by *Macrophomina phaseolina* and propagule populations in Arizona field soil. Pl. Dis. 68:587-589.
- MIHAIL, J.D. and ALCORN, S.M. 1984. Powdery mildew (*Leveillula taurica*) on native and cultivated plants in Arizona. Pl. Dis. 68:625-626.
- COTTY, P.J. and ALCORN, S.M. 1984. *Alternaria raphani* on turnip in Arizona. Pl. Dis. 68:732.
- ROTKIS, P.T. and ALCORN, S.M. 1984. Susceptibility of native plants to three soil-borne fungi endemic to the southwestern United States.

02.004 CRIS0065459
EVALUATION OF PLANT GROWTH SUBSTANCES AND HERBICIDES ON SELECTED PLANT SYSTEMS

BARTELS P G: Plant Science; University of Arizona, Tucson, ARIZONA 85721.
Proj. No.: ARZT-171108-H-25-41

Project Type: HATCH
Agency ID: CSRS Period: 01 OCT 83 to 30 SEP 86

Objectives: To evaluate the hypothesis that selected plant growth substances and herbicides influence growth and development of corn seedlings and root development of mung bean stem cuttings by modifying the endogenous hormonal system of the plants.

Approach: Light and dark grown corn seedlings or stem cuttings will be treated with plant growth substances (PGS) or herbicides at various rates and times during development of the plants. Following the PGS treatment, endogenous plant hormones such as IAA will be extracted, purified, and concentration determined. High performance liquid chromatography will be used to analyze and determine the concentration of hormones present in the extracts of the treated and control plants.

Progress: 84/01 to 84/12. Root initiation and rooting of mung bean stem cuttings (*Phaseolus vulgaris*) can be enhanced by culturing the cuttings in a media containing boron, calcium and indolebutyric acid. Treatment of stem cuttings of *Cuphea procumvens* with a combination of boron (10 ug/ml) and indolebutyric acid (10 M) for 12 days at 25C under a 12-hour photoperiod produced more root initials than stem cutting treated with water only, indolebutyric acid (10 M) only or boron (10 ug/ml) only. The water treatment produced an average of 24 roots per stem cutting with average root lengths of 7 mm; boron treatment produced 4 roots per cutting with root lengths of 9 mm; indolebutyric acid treatment resulted

in 75 roots per stem cutting with root lengths of 3 mm, whereas treatment with boron combined with indolebutyric acid produced 80 roots per stem cutting with an average root length of 3 mm. *Cuphea procumvens* is being developed as a crop plant for production medium size triglycerides. This species is usually propagated by asexual means rather than by sexual means to obtain new hybrids. Examination of paraffin sections from rooting stem cuttings at the end of the treatment period showed that the root initials developed from the phloem ray tissue of the cut stem. The location of the roots along the stem varied among treatments. The boron-indole-butyrac acid treatment produced roots along the entire stems, whereas boron treatment produced roots only at the base of the cut stem.

Publications: 84/01 to 84/12

- FOSTER, K.F., BARTELS, P.G., HOFMANN, W.C., and KARPISCAK, M.M. 1984. An assessment of salt drift on productivity of agricultural crops. University of Arizona, College of Agriculture.

02.005 CRIS0002669
LIPID METABOLISM IN HIGHER PLANTS

STUMPF P K; Biochemistry & Biophysics; University of California, Davis, CALIFORNIA 95616.

Proj. No.: CA-D*-BBP-1934-H Project Type: HATCH
Agency ID: CSRS Period: 13 MAY 60 to 30 SEP 84

Objectives: Study the synthesis of fatty acids in higher plants, with emphasis on the synthesis of short and medium chain fatty acids.

Approach: Little is known about chain termination and the development of new crops for the synthesis of fatty acids. The subgenus *Cuphea* and *Eucuphea* contain a high portion of C(8), C(10) and C(12) fatty acids. We will explore the biosynthetic pathway of these fatty acids.

Progress: 84/01 to 84/12. The biosynthesis of very long chain fatty acids in leaf epidermal tissue has been defined. The synthesis of fatty acids and complex lipids has been explored in *Lemna minor*. The characterization of the triangle desaturase in safflower seeds has been completed.

Publications: 84/01 to 84/12

- SANCHEZ, J. and STUMPF, P.K. 1984. The effect of hypolipidemic drugs WY14643 and DH990, and lysophospholipids on the metabolism of oleate in plants. Arch. Biochem. Biophys. 228, 185-196.
- LEM, N.W. and STUMPF, P.K. 1984. In vitro fatty acid synthesis and complex lipid metabolism in the cyanobacterium *Anabaena variabilis*. Plant Physiol. 74, 134-138.
- STUMPF, P.K. 1984. Fatty acid biosynthesis in higher plants. In: Fatty Acid Metabolism and Its Regulation (S. Numa, ed.), chapt. 6. Elsevier Science Publishers, B.V.

02.006* CRIS0044718
**ISOLATION AND IDENTIFICATION OF ALLELOCHEMICALS
 FROM UNCULTIVATED PLANTS**

KLEIMAN R; SPENCER G F; WOLF R B; Northern
 Regional Res Center, Peoria, **ILLINOIS** 61604.
 Proj. No.: 3620-20160-009-00D

Project Type: INHOUSE
 Agency ID: ARS Period: 02 OCT 78 to 16 APR 87

Objectives: Detection and identification of
 phytochemical agents potentially useful in weed
 control and plant growth regulation.

Approach: Screen for useful biological activity
 such as bioregulation in extracts from seed and
 other plant parts. Activity will be measured by
 relative germination rates of selected weed
 seeds. Active principles will be isolated and
 characterized by chromatographic and
 spectroscopic means.

Progress: 83/01 to 83/12. The biological
 screening of extracts from seed of 225 wild
 species revealed germination inhibitors in 21
 of them. Selections from this group will be
 made for isolation and characterization of
 active compounds. Benzyl isothiocyanate, an
 active germination inhibitor of velvetleaf seed
 at the 4×10^{-5} M level did not affect corn
 even at moderately high concentrations such as
 10^{-4} M but did affect soybean at the 10^{-5} M
 level. Soybeans were not affected at the 4×10^{-5} M
 level. The acetone extract of defatted Iva
 axillaris seeds was found to contain
 germination inhibitors tomentosin and ilicic
 acid. Other compounds, such as avivalin, had
 growth inhibitory properties. This work also
 resulted in the isolation a new sesquiterpene,
 tentatively identified as the isovalerate ester
 of ivaxillarin. Computer programs were written
 and data entered in order to have searchable
 files for future reference of germination
 inhibition data. In cooperation with plant
 breeders working in the new crop area, analyses
 for oil, protein, and fatty acids of seed were
 accomplished. Species included in this program
 were rape, crambe, Sapium, Sebiferum, Cuphea,
 and Vernonia.

Publications: 83/01 to 83/12

ABBOTT, T.P., JAMES, C., and PLATTNER, R.D.
 1983. Products of wheat straw
 biodegradation by *Cyathus stercoreus*. ACS
 Symp. Ser. No. 214, Unconventional Sources
 of Dietary fiber, I. Furda, ed., Chap. 19,
 pp. 267-284.

AWL, R.A., FRANKEL, E.N., and TJARKS, L.W.
 Cyclic fatty esters: Stereochemistry of
 monounsaturated products from the
 hydrogenation and reduction of
 9-(6-propyl-3-cyclohexenyl)-8-nonenoic acid
 or ester. Chem. Phys. Lipid.

CARLSON, K.D., CUNNINGHAM, R.L., and HERMAN,
 I.A. 1983. Sweet sorghum grown on
 sludge-amended stripmine soil: A
 preliminary look at yields, composition,
 and ethanol production. Trans. Ill. State
 Acad. Sci. 76:111-122.

CULL, I.M. 1983. Midwest plants for potential
 crops. Trans. Ill. State Acad. Sci.
 76:213-216.

GARCIA, W.J., CAVINS, J.F., INGLET, G.E.,
 HEAGLE, A.S., and KWOLEK, W.F. 1983.
 Quality of corn grain from plants exposed
 to chronic levels of ozone. Cereal Chem.
 60(5):388-391.

02.007 CRIS0047724
DEVELOPMENT OF CUPHEA SPECIES

CAMPBELL T A; Economic Botany Plant Genetics &
 Germplsm Inst; Beltsville Agr Res Center,
 Beltsville, **MARYLAND** 20705.
 Proj. No.: 1208-20162-003-00D

Project Type: INHOUSE
 Agency ID: ARS Period: 18 JUN 82 to 18 JUN 87

Objectives: To develop improved, commercially
 acceptable strains of *Cuphea* spp. which can
 serve as domestic sources of lauric and other
 medium chainlength fatty acids. Specific
 objectives are to evaluate available germplasm
 chemically, genetically, and agronomically, and
 determine the nature and scope of de- terrents
 to the effective commercial use of this genus;
 correct these deficiencies through breeding
 improved strains.

Approach: Collection of *Cuphea* spp. in Mexico
 (1981) and Brazil (1982). Identification of
 C(12) accessions through chemical analysis.
 Agronomic evaluation of C(12) germplasm under
 several environments and selection of
 especially promising plants. Implementation of
 a breeding program designed to
 produce agronomically superior strains.

Progress: 83/01 to 83/12. The effects of 0,
 0.01, 0.02, 0.04, 0.08, and 0.16 M ethyl
 methane sulfonate and 0, .0005, .001 and .002 M
 sodium azide on *Cuphea toluicana* and *Cuphea*
wrightii were studied. Both chemicals were
 applied to seeds. For the EMS study, mean
 height ranged from 4.5 cm (0 M) to 3.3 cm (0.04
 M) and % emergence from 24% (0 M) to 13% (0.8
 M). For the sodium azide study, height ranged
 from 3.9 cm (0 M) to 2.5 cm (0.002 M) and %
 emergence from 29 (0 M) to 13 (.002 M). No
 mutagen-induced- macro-mutations were noted in
 the M(2) generation and there was no species x
 mutagen treatment interaction. In a test of the
 effects of gamma radiation applied to seeds
 equilibrated at 2% moisture, *C. wrightii* was
 more tolerant than *C. toluicana*. An ideal rate
 (50% height reduction) for *C. wrightii* appears
 to be 15 to 20 Kr and for *C. toluicana*, ca. 12
 Kr. A definite temperature x phytochrome
 interaction was observed in *C. toluicana*. An
 ideal germination temperature was 25 C; red
 light increased germination markedly. Several
 weeks of after-ripening at 45 C was necessary
 before light treatment was effective.

Publications: 83/01 to 83/12

NO PUBLICATIONS REPORTED THIS PERIOD.

02.008 CRIS0095529
DEVELOPMENT OF CUPHEA SPECIES AS AN OIL CROP
FOR OREGON

KNAPP S J; JOLLIFF G D; GRABE D F; Crop
Science; Oregon State University, Corvallis,
OREGON 97331.
Proj. No.: ORE00001 Project Type: STATE
Agency ID: SAES Period: 01 JUL 85 to 30 JUN 90

Objectives: To evaluate Cuphea species as a possible new crop for Oregon. Develop new germplasm and commercially accepted lines of Cuphea. Develop agronomic technology to assess the potential of Cuphea as a commercial oil crop. Evaluate the quality and quantity of Cuphea fatty acids.

Approach: Adaptation trials will be conducted in various locations in Oregon to establish the potential of Cuphea. Evaluate new germplasm and develop breeding methods to improve the existing species. Assess the agronomic potential and develop the agronomy technology necessary to establish Cuphea as a new oil crop. Characterize the seed dormancy and germination requirements of Cuphea. Determine the fatty acid composition of seed oils from the selected Cuphea species.

02.009 CRIS0048426
CUPHEA GERMPLASM EVALUATION, DEVELOPMENT, AND
DOMESTICATION

THOMPSON A E; JOLLIFF G D; Crop Science;
Oregon State University, Corvallis, OREGON
97331.
Proj. No.: 5422-20160-004-01S
Project Type: COOPERATIVE AGREE.
Agency ID: ARS Period: 28 SEP 83 to 30 SEP 87

Objectives: Evaluate and develop improved Cuphea germplasm, achieve domestication, and develop appropriate agronomic practices for new oilseed crop to serve as domestic source of lauric acid and other medium chain triglycerides.

Approach: Evaluate Cuphea germplasm for agronomic characters, mode of reproduction, seed yield and quality, and adaptation to climatic and ecological conditions in the Pacific Northwest. Select and develop germplasm for a wide array of growing conditions, and develop breeding lines capable of commercial production. Develop improved cultural and management methods for efficient crop production of improved Cuphea germplasm and cultivars.

Progress: 83/09 to 83/12. Twenty-one species of Cuphea were evaluated under field conditions for various agronomic traits with emphasis on seed germination, emergence, plant vigor and height, flowering, and seed set. Six annual species within the genus section Heterodon gave the best performance and highest seed yield. These include Cuphea glossostoma, C. laminuligera, C. leptopoda, C. lutea, C. inflata, and C. wrightii. Multiple mechanical

harvesting of C. wrightii for the first time on a field scale at Corvallis, OR and Davis, CA give seed yields ranging from 200-850 kg/ha.

Publications: 83/09 to 83/12
NO PUBLICATIONS REPORTED THIS PERIOD.

02.010 CRIS0004420
TESTING OF IMPROVED CROP CULTIVARS AND SPECIES
IN SOUTHERN OREGON

YUNGEN J A; S Oregon Agric Expt Station,
Medford, OREGON 97502.
Proj. No.: ORE00272 Project Type: STATE
Agency ID: SAES Period: 01 JUL 85 to 30 JUN 90

Objectives: Determine the adaption of cultivars of cereals, field corn, legumes, forbs, grasses, and seed crops under the soil and climatic conditions of the southern Oregon area. Explore the adaptability and feasibility of new or specialty crops for production on farms of varying sizes with emphasis on seed production, oilseeds, and crops that provide raw materials for alcohol or other energy-related products.

Approach: Field plot nurseries will be used for testing cultivars and species to make comparative evaluations. Greenhouse trials will be used to obtain preliminary information on new crops. Yield data will be a measure of adaptability along with observations on soil and climatic adaptation. Crop quality will be evaluated by mechanical and/or chemical tests on seeds and plant parts.

Progress: 84/01 to 84/12. Of 10 flowers for seed, silene, mirabilis, rudbeckia, and oenothera yielded well and matured during favorable harvest weather. Clarkia and bells of Ireland were intermediate, while lupin, nasturtium, lobelia, and helianthus were low in relative yield. Fourth year yields of WL 314, Amador, Lahontan, and WL 313, among 22 alfalfas, exceeded 6.0 tons of dry forage/a in four cuttings. Resistance to bacterial wilt is essential and tolerance to Phytophthora root rot is desirable, if stands are to remain productive at least 5 years on soils ranging in texture from sandy loams to clays. Several entries incorporate resistance to both diseases and to some other pathogens and insects. Four of 12 field corns yielded more than 11 tons of dry matter/a, harvested at the early/medium dent stage for silage. Growth periods were from 129 to 146 days and heat units were from 2,038 to 2,281. Grain/silage-stage ratios were high, ranging from 244-326 lbs of shelled corn at 15% moisture/ton of silage-stage material at 72% moisture. Relative maturity ratings were from 95 to 124 days. Cuphea wrightii matured seed well, but recovery was limited to one early harvest with a yield of 221 lbs/a, because adverse weather prevented a successful maincrop harvest. Greater yield, larger seeds, greater seed retention, and more concentrated maturity should be objectives of a breeding program to enhance its commercial potential.

Publications: 84/01 to 84/12

YUNGEN, J.A. 1984. Agronomic and Truck Crops
Report. Southern Oregon Experiment Station,
Medford, OR. Unpub.

02.011 CRIS0013773
**IMPROVING AGRONOMIC CROP PRODUCTION METHODS IN
THE SOUTHERN OREGON AREA**

YUNGEN J A; S Oregon Agric Expt Station,
Medford, OREGON 97502.
Proj. No.: ORE00186 Project Type: STATE
Agency ID: SAES Period: 01 JUL 85 to 30 JUN 90

Objectives: Develop the basis for recommending the efficient application of fertilizers and/or soil amendments for production of agronomic crops. Develop and/or modify, as soil and climatic conditions warrant, weed control recommendations for agronomic crops on several major soil mapping units. Improve production efficiency through plant population and planting studies, modified tillage, improved seed harvest techniques, and by development of double-cropping sequences for irrigated soils.

Approach: Field plot trials will be used to obtain data to accomplish the objectives. Supplemental information will be obtained from greenhouse trials and plant and soil analyses.

Progress: 84/01 to 84/12. Nitrogen rates applied to winter wheat March 9 increased grain yields more than January 26 applications. Split N applications showed no consistent advantage over early or late single applications. Yields were highest with 80 and 120 N, trending downward at 160 and 200 N. Volunteer Jerusalem artichoke was effectively controlled with 2,4-D at 0.5 and 1.0 lb/a and with dicamba at 0.12 lb/a although dicamba limited the barley's height. Control averaged 92, 94, and 90%, respectively. DPX 6376 at 0.25 and 0.5 oz/a resulted in 82 and 86% control, respectively. Chlorsulfuron at 0.25 and 0.5 Oz/a resulted in 60 and 66% control. Several other herbicides offered less control, applied at 3-5 leaf and tillered stages. Among 10 flowers grown for seed production, helianthus and oenothera showed acceptable tolerance to field rates of trifluralin in the greenhouse and in the field. Clarkia, lobelia, and rudbeckia showed slightly less tolerance. Marginal tolerances were shown by nasturtium, mirabilis, and lupin. Helianthus showed good tolerance to EPTC, while lupin, mirabilis, and nasturtium showed marginal tolerances. Bells of Ireland and silene showed little tolerance to either herbicide. Cuphea, C. Wrightii, an oilseed crop that contains mid-length triglycerides of interest to the soap and detergent industry, was found quite tolerant of ppi trifluralin, with slightly less tolerance to ppi EPTC.

Publications: 84/01 to 84/12

YUNGEN, J.A. 1984. Agronomic and Truck Crops
Report. Southern Oregon Experiment Station,
Medford, OR. Unpub.

COM 03 GUAYULE

03.001 CRISO140559 GUAYULE RUBBER QUALITY FOR STORAGE AND VARIOUS CULTURAL PRACTICES

BUCKS D A; NAKAYAMA F S; HAMERSTRAND G E; Arid Zone Crop Prod Res U. S. Water Conservation Lab; Agricultural Research Service, Phoenix, ARIZONA 85040.

Proj. No.: 5422-20740-012-03R

Project Type: INHOUSE

Agency ID: ARS Period: 01 OCT 85 to 30 AUG 86

Objectives: Determine the influence of selected cultural practices on guayule rubber quality.

Approach: Lab analysis of field grown guayule will establish statistical correlations (multiple and regular) between rubber quality (molecular weight distribution, viscosity, shown strength, and plasticity) and agronomic traits and cultural practices such as shrub age. The short-term rubber quality research will be investigated at the U.S. Water Conservation Laboratory, Phoenix, Arizona, whereas the longer-term processing and storage life aspects of rubber quality will be studied at the Northern Regional Research Laboratory, Peoria, Illinois. Reimbursable with Department of Defense.

03.002 CRISO047196 WATER AND AGRONOMIC MANAGEMENT FOR EFFICIENT COMMERCIAL GUAYULE RUBBER PRODUCTION

NAKAYAMA F S; BUCKS D A; KIMBALL B A; Exploratory Organic Reactions Oilseed Crops Lab; Agricultural Research Service, Phoenix, ARIZONA 85040.

Proj. No.: 5422-20740-012-00D

Project Type: INHOUSE

Agency ID: ARS Period: 13 JUL 81 to 13 JUL 86

Objectives: Develop water and agronomic management practices for commercializing guayule rubber production under various climatic conditions.

Approach: Guayule plants will be grown under various soil moisture regimes and fertility levels at various sites with extensive monitoring of soil water content, meteorological parameters including humidity, air and plant temperatures, wind speed, light intensities, carbon dioxide concentration, and biological parameters including plant water potential, leaf resistance, growth, biomass and photosynthesis. Rubber yield will be related to water use and plant water stress. Remote sensing techniques will be incorporated into the irrigation scheduling for maximizing rubber production and water-use efficiency. Growth and rubber yield models will be developed for a range of climatic conditions from the data collected.

Progress: 83/01 to 83/12. Data are systematically being collected and analyzed for rubber yield, water use efficiency, water-stress, hydrocarbon emission and photosynthesis, and regional uniformity trials

at Mesa, Phoenix and Yuma, AZ, and Brawley, CA. Cooperative studies involve seed treatment, direct seeding, harvesting techniques, and rubber quality. Periodic harvests showed that rubber yields were about 1300 kg/ha for the highest (3940 mm) and 710 kg/ha for the lowest (1940 mm) water application (irrigation + rain) for the 23-month plants. Rubber content follows a seasonal pattern; the two optimum harvest dates would be at the end of the plant dormancy, February to March, and after summer growth in October and November. Maximum hydrocarbon emission and photosynthesis occurred in June-July and minimum in the December-January periods. Yield and crop stress results indicate that guayule is more sensitive to water stress in the latter rather than the first half of the year. Different stress evaluators such as leaf water content, canopy minus air temperatures, and crop water stress indexing show similar response to plant behavior. Water-use efficiencies ranged from 3 to 4 kg/ha per cm of evapotranspiration. Drought tolerance permits flexibility in irrigation scheduling, but to optimize yield and shorten the growth cycle, more water must be used. The rubber analysis technique developed was accepted by the Guayule Rubber Society as a standard method.

Publications: 83/01 to 83/12

NAKAYAMA, F.S., and BUCKS, D.A. 1983.

Application of a foliage temperature based crop water stress index to guayule. J. Arid Environ. 6:269-276.

BLACK, L.T., HAMERSTRAND, G.E., NAKAYAMA, F.S., and RASNICK, B.A. 1983. Gravimetric analysis for determining the resin and rubber content of guayule. Rubber Chem. Technol. 56(2):367-371.

NAKAYAMA, F.S. 1983. Hydrocarbon emission and carbon balance of guayule. J. Arid Environ. (In Press)

EHRLER, W.L., and NAKAYAMA, F.S. 1983. Water stress status in guayule as measured by relative leaf water content. Crop Sci. (In Press)

BUCKS, D.A., NAKAYAMA, F.S., and FRENCH, O.F. 1983. Water management for maximum guayule rubber production. Transactions ASAE. (In Press)

03.003 CRISO048906 GUAYULE RUBBER QUALITY AS RELATED TO AGRONOMIC MANAGEMENT PRACTICES

BACKHAUS R A; NAKAYAMA F S; Division of Agriculture; Arizona State University, Tempe, ARIZONA 85281.

Proj. No.: 5090-20746-015-00S

Project Type: COOPERATIVE AGREE.

Agency ID: ARS Period: 29 SEP 83 to 30 SEP 84

Objectives: Determine the quality of rubber produced under different types of irrigation management, fertility levels, plant age, harvesting techniques, and storage.

Approach: Molecular weight of rubber polymer analyzed by high performance liquid chromatographic or viscometric techniques will be used as basis for classifying rubber

quality. Since high molecular weight rubber is preferred for formulating rubber products, factors which may affect this parameter such as plant age and species, water and fertilizer management, climate, harvesting technique and storage will be investigated on ongoing research that is being conducted under ARS auspices.

Progress: 83/09 to 83/12. Analytical procedures and equipment have been developed to determine molecular weight of guayule rubber. The molecular weight changes were followed for one series of plant samples under different storage environments. Molecular weight decrease was least when the sample was stored under water and greatest when the ground plant samples were exposed to air.

Publications: 83/09 to 83/12
NO PUBLICATIONS REPORTED THIS PERIOD.

03.004 CRIS0047502
GUAYULE RUBBER PRODUCTION RELATED TO WATER AND NUTRIENT REQUIREMENTS IN SANDY SOILS

BUCKS D A; ROTH R L; Soil Water & Engineering; Safford Agric Expt Station, Safford, ARIZONA 85546.
Proj. No.: 5422-20741-012-01S

Project Type: COOPERATIVE AGREE.
Agency ID: ARS Period: 12 JAN 82 to 30 SEP 86

Objectives: Determine guayule irrigation and minimum and maximum fertility requirements on marginal agricultural land with limited surface and groundwater supplies.

Approach: Guayule transplants will be grown using five irrigation and five nitrogen levels on Superstition sand (approximately 91% sand) under an automated, linear-move sprinkler irrigation system. The evapotranspiration (ET) of guayule will be determined from soil-water depletion measurements, and meteorological factors affecting ET will be monitored. Basic plant measurements will include growth, rubber yield with time, and plant tissues analysis. Low levels of water and fertility will be used to simulate marginal land with a limited water supply; high levels will represent possible problems from excess water and nutrient imbalance. It is intended that this research include PHASES II, III, and IV to be funded in subsequent years.

Progress: 83/01 to 83/12. Work was continued on experimental plots established in January 1982 at Yuma, and where five differential irrigation and nitrogen levels were started in May 1982. Final harvest data will not be obtained until 1985. However, periodic plant sampling for resin, rubber and nitrate contents, shrub weight, leaf area, and plant morphology measurements are being made. Application of irrigation water, soil water content and meteorological parameters are also being monitored. Available results show larger plant volume and crown diameter, dry weight, resin and rubber yield with the larger water applications. Monthly nitrogen levels in the leaves reflect the irrigation-nitrogen

treatment, but no critical level can be established yet.

Publications: 83/01 to 83/12
NO PUBLICATIONS REPORTED THIS PERIOD.

03.005 CRIS0082515
WATER AND NITROGEN PRODUCTION FUNCTIONS FOR ARIZONA CROPS

ROTH R L; GARDNER B R; PEW W D; Agri Engineering; University of Arizona, Tucson, ARIZONA 85721.
Proj. No.: ARZT-101853-S-22-221

Project Type: STATE
Agency ID: SAES Period: 01 JUL 84 to 30 JUN 87

Objectives: Determine crop production function for various crops for different levels of water and nitrogen applied through a self-moving lateral sprinkler system. Monitor salt levels in the soil profile and develop irrigation management to prevent excessive salt accumulations. Monitor soil moisture using neutron probe readings and crop canopy temperatures with an infrared temperature gun to develop a crop stress index.

Approach: A central composite rotatable statistical design of 2 variables, water and nitrogen, is used to determine a crop response function for each crop grown. The water levels vary from 50% to 150% consumptive use and the nitrogen levels vary from 33% to 167% of the crop requirement. The statistical design defines 5 different water and 5 different nitrogen levels. Each combination of water and nitrogen levels are applied to plots 60x30 feet. All related crop measurements are made to determine the crop response function.

Progress: 84/01 to 84/12. Yield production functions of water and nitrogen variables were determined for several crops. A central composite rotatable statistical design was used to include a 50-150% range of water applied and 33-167% range of nitrogen applied, where 100% would result in maximum production. The yield data collected were fitted by regression to a quadratic equation. The guayule results from two-year-old plants are presented. Dry weight, resin and rubber content and yield were significantly different at the 5% level for whole, clipped, and bioregulator plants harvested at two years of age. Production functions based on water and nitrogen applications were developed to predict the growth habit and highest yield potential. Although guayule can withstand extreme drought, water and fertilizer applications of more than about 2850 mm (112 in) and 210 kg/ha (190 lb/ac) were required to achieve the most production in two years under the soil and environmental conditions in western Arizona. Resin yields of 1900 kg/ha (1695 lb/ac) and rubber yields of 1500 kg/ha (1340 lb/ac) on the sandy soil were some of the highest ever reported with present-day guayule cultivars and were possibly due to better soil aeration, a longer effective growing season, and more effective plant root development than in other situations. The bioregulator sprayings did not

improve yields to date for the various water and nitrogen treatments.

Publications: 84/01 to 84/12

BUCKS, D.A. ROTH, R.L. NAKAYMA F.S. and GARDNER, B.R. 1984. Water and Nitrogen Requirements for Guayule Rubber Production. ASAE Paper No. 84-2095. Presented at 1984 Summer ASAE Meeting. University of Tennessee, Knoxville.

03.006

CRISO088201

ALTERNATIVES TO DESERTIFICATION IN ARID LANDS AGRICULTURE

FOSTER K E; WRIGHT N G; Office of Arid Lands Studies; University of Arizona, Tucson, ARIZONA 85721.

Proj. No.: ARZT-857254-G-60

Project Type: SPECIAL GRANT

Agency ID: CSRS Period: 15 AUG 82 to 31 AUG 85

Objectives: To examine the range of economic and agronomic conditions that might stimulate the development of jojoba, guayule, buffalo gourd, Russian thistle.

Approach: Refinement of economic production costs for the four crops in four areas, southern California, central Arizona, southwest New Mexico, and West Texas. Discussion of impacts of land, water, commodity tradeoffs and environment; and integration of Phase 1 and 2 into a commercialization outlook.

Progress: 81/01 to 81/12. Final cost budgets for guayule seed production were developed using the Digital Rainbow computer. These budgets use Super Calc software and is the first computer program that is available for guayule seed production analysis. Jojoba, buffalo gourd and Russian thistle budgets will be upgraded in 1985 using the same software. Final analysis of these low water use native plants and the infrastructure of these crops in arid lands agriculture is completed and ready for write-up.

Publications: 81/01 to 81/12

WRIGHT, N.G., LACEWELL, R.D. and TAYLOR, J.G. Cash Flow Summary for Producing One Acre of Guayule on Commercial Farms in the Southwestern U.S. Paper presented at the Guayule Rubber Society Fifth Annual Conference Washington.

WRIGHT, N.G. Contributed guayule rubber production budgets for Technical Bulletin 252. Agricultural Experiment Station, University of 252.

03.007*

CRISO081511

DISEASES OF "NEW CROPS" WITH EMPHASIS ON GUAR AND GUAYULE

ALCORN S M; Plant Pathology; University of Arizona, Tucson, ARIZONA 85721.

Proj. No.: ARZT-173666-H-05-24

Project Type: HATCH

Agency ID: CSRS Period: 01 OCT 83 to 30 SEP 86

Objectives: To determine the environmental-cultural factors which favor the epidemiologies of important pathogens and the expression of symptoms by hosts; to develop control procedures.

Approach: Twenty four a will be accomplished by determining causes of diseases of various aged guayules growing in various areas under varying irrigation regimes and from greenhouse-growth chamber studies.

Progress: 84/01 to 84/12. *Tilletia cuneatum* has been identified as causing a flower smut in experimental plantings of *Grindelia camporum*. The smut appears to have been introduced via seeds collected from *Grindelia* plants growing in the wild in California. Dying plants of *Cucurbita digitata* (in experimental plantings) had rotting roots from which pectolytic bacteria and *Rhizoctonia* spp. have been isolated. Koch's postulate studies are in progress. Experimental field plantings of *Cuphea Wrightii* and *C. toluhana* were evidencing damping-off symptoms. Associated with stem and/or root lesions were *Fusarium* spp., *Rhizoctonia* spp., a *Pythium* spp., and several other fungi probably in the *Phythiaceae*. *Euphorbia lathyris* direct seeded in the field in October can be infected by *Macrophomina phaseolina* by January but remain symptomless until the following summer. In 1983 1.27% of 550 saguaros in 60 acres of plots died from bacterial necrosis; 2.73% were lost from all causes. Since approximately 1941, approximately 67.6% of all saguaros (including new plants occurring since 1941) in these plots no longer survive. Of those lost, 85.3% (977 plants; 57.6% of all plants) had symptoms of bacterial necrosis. For information on guayule see 80-CRSE-2-0637 and 84-CRSE-2-2366 and on jojoba see SRZT-174112-H-05-303.

Publications: 84/01 to 84/12

MIHAIL, J.D. and ALCORN, S.M. 1984. Effects of soil solarization on *Macrophomina phaseolina* and *Sclerotium rolfsii*. Pl. Dis. 68:156-159.

YOUNG, D.J. and ALCORN, S.M. 1984. Latent infection of *Euphorbia lathyris* and weeds by *Macrophomina phaseolina* and propagule populations in Arizona field soil. Pl. Dis. 68:587-589.

MIHAIL, J.D. and ALCORN, S.M. 1984. Powdery mildew (*Leveillula taurica*) on native and cultivated plants in Arizona. Pl. Dis. 68:625-626.

COTTY, P.J. and ALCORN, S.M. 1984. *Alternaria raphani* on turnip in Arizona. Pl. Dis. 68:732.

ROTKIS, P.T. and ALCORN, S.M. 1984. Susceptibility of native plants to three soil-borne fungi endemic to the southwestern United States.

03.008 CRIS0082459
IDENTIFICATION AND CONTROL OF GUAYULE DISEASES

ALCORN S M; MISAGHI I; Plant Pathology;
University of Arizona, Tucson, ARIZONA 85721.
Proj. No.: ARZT-856731-G-05

Project Type: NATIVE LATEX
Agency ID: CSRS Period: 01 SEP 80 to 31 AUG 85

Objectives: To identify pathogens of guayule in Southwestern United States and Mexico; to evaluate bacteria as stimulators of guayule growth; to develop disease-control methods using antagonistic microbes, chemicals, and/or resistant plants.

Approach: Standard techniques will be used to determine guayule pathogens; bacteria will be isolated from field soils and screened for growth promoting activities on guayule lines and for their suppression of pathogens; the efficacy of selected chemicals for controlling guayule diseases will be evaluated in the greenhouse and field; guayule lines will be multiply screened against selected guayule pathogens in the greenhouse and field.

Progress: 84/01 to 84/12. Twenty lines (909 plants), from Ali Estilai were screened for Verticillium tolerance. 81 Plants that survived 3 inoculations were returned to Ali. 1500 F seedlings from 10 open pollinated, verified diploids surviving 2-3 rounds of inoculations (in the greenhouse) with Verticillium dahliae, in turn were screened for Vert. tolerance. 160 of these survived 3 inoculations and have been transplanted into the field. Verified diploids with the best rubber yields should be released in 1985. Despite repeated attempts were are still unable to reisolate Verticillium from all test plants inoculated (in the GH) and showing typical symptoms, including vascular discoloration. Dr. J. Mihail has developed techniques which assure 100% infection of guayule seedlings by Macrophomina phaseolina in the GH. Under the most stringent conditions 4-7wk-old seedlings of all the following tetraploids died within 72 hr: AZ 101, A48118, N396, N565, N565II, N576-Lot 1, 593, N596, 11591-Lot 4, 11605-Lot 1, 11605-82, 11619 Var 2E, 11646, 12229, 12231, and 4256XF (all seeds from Dr. D. Rubis). A variation of this procedure has been developed which assures 100% infection but with less than 70% of the plants showing symptoms. This technique will be used to screen tetraploids and Verticillium-resistant diploids for Macro resistance. Four percent to 70% of cuttings from diploids have rooted in tests to date; we will continue in attempts to uniformly achieve a high percentage of rooting.

Publications: 84/01 to 84/12

MIHAIL, J.D. and ALCORN, S.M. 1984. Effects of soil solarization on Macrophomina phaseolina and Sclerotium rolfsii. Pl. Dis. 68:156-159.

03.009 CRIS0093260
RESEARCH AND DEVELOPMENT OF GUAYULE AS A CROP IN ARIZONA AND THE SOUTHWEST

ALCORN S M; RAY D T; RUBIS D D; Plant Pathology & Plant Sci; University of Arizona, Tucson, ARIZONA 85721.
Proj. No.: ARZT-857618-G-05

Project Type: NATIVE LATEX
Agency ID: CSRS Period: 01 JUN 84 to 31 MAY 86

Objectives: To: improve rubber yields; cooperate in regional tests of lines; produce seeds of selected lines; determine cultural conditions & time of harvest which maximize rubber yields; diagnose & assess disease losses; develop disease control procedures, particularly germplasm tolerant to Vert. wilt & Macrophomina phaseolina.

Approach: Standard techniques will be used to develop new lines. Plants with favorable growth habits & rubber yields will be cytologically characterized & kept; plants will be grown & evaluated for growth habits & rubber yields according to standard protocol. There will be similar tests in 3 other states; plants will be maintained to facilitate seed set & harvests. Seeds will be cleaned, weighed, & packaged; rubber yields will be determined seasonally & following various cultural procedures; standard protocol will be used to identify organisms isolated from "sick" plants & to assess their impact in terms of farming practices. Koch's Postulates will be followed as needed; screenings of F1 & F2 progeny of diploid plants tolerant to Vert. will continue. Procedures for similar tests with M. phaseolina will be developed.

Progress: 84/06 to 84/12. Highest rubber yeilds were in March-May in wet plots of plants grown 1 yr. under 3 irrigation regimes; quality was lowest in April. In other tests, March was the best month for evaluating rubber % and yeild. Bees significantly increases weights and numbers of achenes of 4 lines in caged and open-pollinated plots. Flowering and seed-set effects on rubber yeilds of 4 lines are being studied. A comparative yield (latex) test of 6 USDA check lines, 5 germplasm lines, and 265 single plant selections (from mostly diploid plants) has been started. Initial data indicate that multiseedling transplants should markedly reduce the cost of producing transplants and eliminate the variations in plant size in the field; tests with varying numbers of seedlings per transplant will be made. Seeds were harvested in the spring and fall from var. 11591, 11605, 11619, 12229, N565, and N567 but much was lost from shattering by rain at harvest-time. Fields of 11604 and 11634 will be ready for seed-harvest in the spring of 1985. Trimming plants to hedge-shaped rows and fertilizing with CaNO(3) increased seed yields. Of 909 plants (from 20 lines from Dr. Estilai) screened for tolerance to V. dahliae, 81 (12 lines) surviving 3 inoc. were kept. 160 of 1500 F(1) plants (from diploids surviving 2-3 inoc. with Vert) in turn survived 3 inoculations. Seeds from the best rubber producers will be released. 100% of 4-14-wk-old seedlings have been infected in the GH with M. phaseolina.

Publications: 84/06 to 84/12

- ABRAHAMS, J. 1984. Direct seeding of guayule using drip irrigation. M.S. Thesis University of Arizona. 64 p.
- FANGMEIER, D.D., GARROT, D.J. JR., and RAY, D.T. 1984. Response of guayule to water in Arizona. The Program and Summaries of the 5th Annual Conf. of the Guayule Rubber Society. Washington, D.C. p. 75(Abstr.).
- FANGMEIER, D.D., SANNANI, Z., GARROT, D.J. JR., and RAY, D.T. 1984. Water requirements of guayule for rubber production. 1984 Winter Meeting, The American Society of Agricultural Engineers. Paper No. 84-2519.
- FANGMEIER, D.D., RUBIS, D.D., TAYLOR, B.B. and FOSTER, K.E. 1984. Guayule for rubber production in Arizona. Arizona Agricultural Experiment Station Tech. Bul. 252. 14p.
- GARROT, D.J. JR. 1984. Water and stress effects on growth and rubber accumulation in guayule (*Parthenium argentatum* Gray). Ph.D. Dissertation, University of Arizona. 77 p.

03.010 CRIS0084379
PLANT REGENERATION AND SYNTHESIS OF USEFUL SECONDARY PRODUCTS FROM CELL SUSPENSION CULTURES

KATTERMAN F R; Plant Science; University of Arizona, Tucson, ARIZONA 85721.
 Proj. No.: ARZT-173871-H-25-12

Project Type: HATCH
 Agency ID: CSRS Period: 01 OCT 84 to 30 SEP 87

Objectives: To examine the processes of callus differentiation with regard to DNA synthesis antagonists and cytokinins. Selection of resistant or conditional mutants. Selection of callus lines and determination of the most favorable conditions for the maximum biosynthesis of economically valuable secondary products. Establishment of culture conditions for the culturing of viable protoplasts to the macro-callus stage.

Approach: Once we have made a comparative study of our systems to that of the differentiating and non-differentiating models with regard to relative levels of BUdR, thymidine, and cytokinin, we will examine the effects of these relative and competing levels on several specific enzymes. In addition, further studies on the regulation of HMG-CoA reductase will be undertaken. Comparisons of enzyme activity will be made between normal *E. lathyris* callus tissue and that of the mevanolin-resistant mutant with regard to varying levels, both separate and interactive, of the basic classes of phytohormones have been added. These results will then be compared to normal tissues to which varying levels of the inhibitor, as well as levels of the phytohormones, have been added.

Progress: 84/01 to 84/12. In order to isolate and culture protoplasts effectively as a prerequisite to any cloning of useful secondary product genes, it was necessary to delineate some of the factors involved in spontaneous protoplast lysis during isolation. The isolation of cotton anther callus

protoplasts is greatly enhanced when the amino acids arginine, serine, or glycine, or the divalent cations Ca or Mg are included in the enzyme mixture. These compounds stabilize cotton protoplasts in the presence of RNase found in the cellulase enzyme mixture. The inhibition of RNase-induced lysis may involve cation or amino acid protection of critical membrane proteins during protoplast isolation. Using these protective agents, cotton protoplasts will give rise to macroscopic callus colonies after 3 weeks in culture.

Publications: 84/01 to 84/12

- THOMAS, J.C. and KATTERMAN, F.R.H. 1984. The control of spontaneous lysis of protoplasts from *Gossypium hirsutum* anther callus. Plant Science Letters. 36:149-154.

03.011 CRIS0079469
DEVELOPMENT OF NEW AND IMPROVED CROPS FOR WATER CONSERVATION IN ARID LANDS

RAY D E; Plant Science; University of Arizona, Tucson, ARIZONA 85721.
 Proj. No.: ARZT-173371-R-25-70

Project Type: HATCH
 Agency ID: CSRS Period: 01 OCT 79 to 30 SEP 85

Objectives: Improve guar (*Cyamopsis tetragonoloba*) production under minimum water regimes through the development of high-yielding varieties adapted to such conditions and to identify efficient production practices for this species. (Arizona, California, Texas).

Approach: Further evaluation of the world collection of guar for maturity, plant type, shatter resistance and yield should provide guar researchers with an estimate of phenotypic stability and yield potential under a variety of environments in Arizona, California and Texas. Since irrigation is expected to be an agronomic practice, water use and irrigation efficiency will be investigated in Arizona and California. Nodulation and nitrogen fixation will be investigated in Arizona and Texas. Genetic male-sterility would provide a simplified, efficient method of producing genetic recombinations. Segregation ratios of fertile to male-sterile individuals and natural outcrossing percentages would provide information concerning phenotypic stability of male-sterility and potential use in male-sterile facilitated recurrent selection populations as well as in conventional breeding programs. Arizona and Texas will evaluate genetic recombination in guar.

Progress: 84/01 to 84/12. Guar (*Cyamopsis tetragonoloba*) Seed yield and yield components were studied as a function of plant density and plant type. Pods, racemes and seed/plant reacted in a strong inverse relationship to plant density and in direct relation to branches per plant. Pods/raceme, racemes/branch and pods/branch increased slower as plant density decreased. Weight/seed, seed/pod and days to first flower were unaffected by density. The influence of 4 temperatures, 5 osmotic potentials, and 3 salts on germination

of 3 varieties were tested under laboratory conditions. Germination decreased with increasing salt and temperatures. A temperature-salinity interaction was observed with the greatest suppression of germination at higher temperatures (34 C and 37 C) and salt concentrations (-11 and -15 bars). Two new varieties "Santa Cruz" and "Lewis" were released jointed with USDA-ARS and the Texas Agricultural Experiment Station. Santa Cruz is a full season, sparse-branching, indeterminate, glabrous selection which yields well at the higher elevations of the production range. Guayule (*Parthenium argentatum*) Plants were grown under 3 irrigation schedules for 1 year. Rubber yield and quality varied seasonally. Highest yields were in wet plots between March and May and quality was lowest in April. Four lines were tested for effect of honey bee pollination upon seed quality and quantity. Achene weight and number/plant were significantly greater in caged and open-pollinated plots with bees.

Publications: 84/01 to 84/12

- MILLIGAN, S.B. 1984. The effect of plant density in guar seed yields and its components. M.S. Thesis, University of Arizona, Tucson. 202 p.
- VINIZKY, I. 1984. The characterization and selection of germination for temperature and salt tolerance in guar. M.S. Thesis, University of Arizona, Tucson. 46 p.
- GARROT, D.J., JR. 1984. Water and stress effects on growth and rubber accumulation in guayule (*Parthenium argentatum* Gray). Ph.D. Dissertation, University of Arizona, Tucson. 77 p.
- RAY, D.T. and STAFFORD, R.D. 1984. Release of "Santa Cruz" guar. Arizona Agricultural Experiment Station and the Agricultural Research Service, United States Department of Agriculture.

03.012 CRIS0082424
GUAYULE IMPROVEMENT UTILIZING THE ARIZONA GERMPLASM COLLECTIONS

RAY D T; Plant Science; University of Arizona, Tucson, **ARIZONA** 85721.
 Proj. No.: ARZT-856695-G-25
 Project Type: NATIVE LATEX
 Agency ID: CSRS Period: 01 SEP 80 to 31 AUG 84

Objectives: To develop broad genetic variability through hybridization: improve water use efficiency; increase seed and seedling vigor and disease resistance; and evaluate genetic sources for herbicide and salt tolerance. The overall goal being to optimize rubber yields in guayule.

Approach: Guayule breeding nurseries will be grown on the Experiment Stations in Arizona (Yuma, Mesa, and Tucson) and on Goodyear Farms at Litchfield Park. The 25 USDA lines will be yield tested at all locations. Water use and guayule development under stress conditions will be evaluated. Seed and seedling vigor will be increased by selection for seed size and general vigor of young plants. Disease resistance studies will be cooperative research

with the Department of Plant Pathology. Inter and intra-specific hybrids will be produced in an effort to broaden genetic diversity for seedling vigor, disease and drought resistance. Herbicide and salt tolerance will be evaluated under artificial growing conditions in preliminary screening studies. Advanced materials will be field grown.

Progress: 80/09 to 84/08. USDA germplasm lines were evaluated at 2, 3, and 4 years of age for % rubber, rubber yield/ha, % resin yield/ha, % dry weight, and dry weight. Line 11604 was highest in % rubber, rubber yield/ha, and % resin. Resin yield/ha was also good. Two-year-old plants were clipped at 4 levels and allowed to regrow for 24 months. All exhibited greater dry weight/plant, resins/plant, and rubber/plant than controls. When rubber was added from originally clipped branches, there was a significant increase of 71% per plant. Large scale clipping studies were initiated to measure the effect of water stress upon survival and rubber yield. Seedlings from open-pollinated diploid plants were screened for resistance to *Verticillium dahliae* in the greenhouse. Lines with continued resistance and high rubber content are being considered for release. A multiple linear regression was utilized to test predictability of rubber and resin yields. Percent rubber and dry weight were best predictors of rubber yield. Percent resin and dry weight are best predictors of resin yield. Guayule waxes are a mixture of linear esters with different combinations of acid and alcohol chains. C48, C50, C54 and C56 esters are main constituents. Over 265 single plant selections are being evaluated. Most are from diploid plants.

Publications: 80/09 to 84/08
 NO PUBLICATIONS REPORTED THIS PERIOD.

03.013 CRIS0001012
IMPROVEMENT OF SAFFLOWER, SOYBEANS, GUAYULE, GUAR, PLANTAGO, AND OTHER SPECIAL CROPS

RUBIS D D; Plant Science; University of Arizona, Tucson, **ARIZONA** 85721.
 Proj. No.: ARZT-170936-H-25-13
 Project Type: HATCH
 Agency ID: CSRS Period: 01 OCT 83 to 30 SEP 86

Objectives: The principle objective is to develop improved varieties in safflower, soybean, guayule, guar, and plantago for specialized purposes in irrigated desert agriculture. Although there are many attributes which need improvement, there will be a special effort for a particular improvement in each crop as follows: develop greater root rot resistance and improved procedures for producing F1 hybrid seed in safflower; combining daylength neutral character with high-yielding, non-shattering soybeans; developing higher rubber yields and higher rubber percentages in guayule; developing normal maturity in higher yielding guar; combining root rot resistance with high yield and height in plantago.

Approach: Different specialized plant breeding methods will be used depending on each special need. Recurrent Selection will be used to develop improved root rot resistance in safflower and plantago. Date-of-Planting Technique will be used to develop the daylength neutral character in guar and to transfer the character in soybeans for higher yield and normal maturity in both. Improved honey bee management and selection for high crossability will be used with the th gene in safflower for improved procedures for producing F1 hybrid seed. Haploids will be used in apomictic guayule to make crosses and produce self-reproducing F1 hybrids. There will be selection for improvement in all characters in all crops on an opportune basis.

Progress: 84/01 to 84/12. Continued efforts in safflower breeding resulted in the development of higher resistance to lygus at Marana. Resistant selections were crossed with the best commercial varieties in 1984. Continued efforts in guar breeding has resulted improved plant types of higher yields. The major improvement is the development of plant selections which mature early and dry for direct combining. Normal varieties stay green when pods mature and must be swathed or frosted before combining. Improved cultural practices in plantago, particularly, earlier planting dates, fertilizer treatments, and weed control have resulted in higher yields at Yuma. Continued selection for resistance in the Fusarium root rot nursery in Tucson has resulted in resistant types with increased height and improved seed quality. In guayule breeding, progress was made in establishing procedures for evaluating breeding lines for rubber production. Monthly harvests showed that the rubber in the plant accumulates during the dormancy period in the winter and that March was the optimum month to evaluate plants for rubber percentage and rubber yield. Preliminary tests have shown that multiple seedling transplants could substantially reduce the greenhouse costs of producing transplants. These transplants eliminate the variability in plant size in the field and result in the true potential yield of each variety. More extensive experiments, involving varying numbers of seedlings per transplant, are ready to be planted in 1985.

Publications: 84/01 to 84/12

- RUBIS, D.D. 1984. Cultural practices and breeding methods for improved rubber yields in guayule. Presented at 5th Annual Meetings Guayule Rubber Society, June 17-21, 1984, Washington, D.C.
- RUBIS, D.D. 1984. Effect of active growth and dormancy on rubber accumulation and yield in guayule. Presented at 5th Annual Meetings Guayule Rubber Society, June 17-21, 1984, Washington, D.C.

03.014

CRIS0001021

DEVELOPMENT OF GUAYULE, GUAR, AND PLANTAGO IN ARIZONA

RUBIS D D; JOHNSON D L; Plant Science; University of Arizona, Tucson, ARIZONA 85721. Proj. No.: ARZT-170914-H-25-05

Project Type: HATCH

Agency ID: CSRS Period: 01 OCT 77 to 30 SEP 83

Objectives: To conduct research programs to develop improved varieties and to develop economic production practices for guayule, guar and plantago. To breed for high rubber yields and high rubber percentage in guayule; higher yields and early maturity in guar; and root resistance and seed-shattering resistance in plantago. The study water use efficiency and develop improved field production practices for guayule, guar, and plantago.

Approach: Guayule breeding nurseries and variety yield tests will be grown on the Experiment Station at Yuma, Mesa and Tucson, and on Goodyear Farms at Lithcfield Park. Guayule varieties and Selections will be tested for yields and rubber percentages. Guayule research on water-use and irrigation will be conducted at Goodyear Farms and demonstration fields will be planted on grower farms for testing production practices and increasing seed. Guar variety yield tests will be conducted at Yuma, Mesa and Marana and breeding nurseries will be planted at Marana and Tucson. Guar water use studies will be conducted at Mesa. Breeding nurseries of plantago will be conducted at Marana and Tucson and production practices will be tested on grower fields.

Progress: 83/01 to 83/09. Continued progress has been made in plantago research which is necessary to establish cultural practices for commercial production. Fertilizer experiments on the Yuma-Mesa sand showed spectacular response to phosphate with over 150% yield increase with only 56 K/h (50 lbs/A) of P whereas up to 224 K/h (200 lbs/A) of N only showed 20 to 30% increases. Wide-row spacing of 38 cm. (15 inches) which permitted controlling weeds by tractor cultivation only reduced yields over drilling at 19 cm. by 20%. It is expected to be much less with taller plantago. New plant types in the guar nursery at Marana showed early plant vigor and higher potential yields. Floods destroyed the nursery before harvesting. Seed was harvested from over 200 plant selections in the guayule breeding nursery during the summer of 1983. The plants will be tested for rubber in the winter when maturation of rubber occurs. Progeny rows from individual plants show considerable variation; however, it is possible to select plant progeny rows with very high uniformity which indicates a very high degree of apomixis. Some of the selections of extremely large plants, such as the line Arizona 101, are showing good rubber percentages but lower molecular weights. This and other plant characteristics indicate that they have originated from crosses to related species such as Parthenium stramonium.

Publications: 83/01 to 83/09

RUBIS, D.D. 1983. Influences of irrigation and fertilizer treatments on guayule. 4th Annual Meeting of Guayule Rubber Society, June 20-24, 1983, Riverside, California.

RUBIS, D.D. 1983. Techniques for conducting yield tests in guayule. 4th Annual Meeting of Guayule Rubber Society, June 20 - 24, 1983. Riverside, California.

RUBIS, D.D. 1983. Five-year summary report of development and improvement of guayule in Arizona. Progress Report to U.S.D.A. Regional Project W-157, September 12 - 13, 1983, Davis, California. Xerox Report 24 p.

03.015 CRIS0082422
**SEED PRODUCTION PRACTICES FOR GUAYULE
 COMMERCIALIZATION**

RUBIS D D; JOHNSON D L; Plant Science;
 University of Arizona, Tucson, **ARIZONA** 85721.
 Proj. No.: ARZT-856719-G-25
 Project Type: NATIVE LATEX
 Agency ID: CSRS Period: 01 SEP 80 to 31 DEC 84

Objectives: To determine field management practices for seed yield and seed quality. To develop procedures for harvesting, threshing and cleaning seed and determine what machinery and equipment to use. To determine optimum conditions for treatment of seed dormancy, for seed germination tests and seed storage conditions.

Approach: Yields, germination percentages, and test weights will be obtained from seed lots continuously harvested during the year from different irrigation treatments, plant spacings, and varieties which are a part of ongoing irrigation and agronomic experiments. Quantity and quality of seed will be determined from hand versus machine harvesting, and from several custom-fabricated and commercial threshers and seed cleaners. The rates and times will be determined for several chemicals for treating seed dormancy, and temperature, light and other specifications will be determined for seed germination tests and storage conditions.

Progress: 84/01 to 84/12. The major accomplishments in 1984 were the development of culture practices for increased seed production and development of seed cleaning and seed germination procedures. Two cultural treatments were tested on a field scale: trimming back the plants or "hedge-shaping" the rows, and the addition of calcium and nitrogen fertilizers. Each treatment increased seed production and the highest seed yields were obtained from the combination of both treatments. Procedures for threshing and seed cleaning were developed for commercial application. The "burr-clover" huller modified to run at 650 rpm proved to be the best thresher. A seed fanning mill with sieves at least as large as 24-1/2 x 22-1/4 with brushes under the sieves proved to be an adequate seed cleaner. A series of sieve sizes and air settings were developed for guayule seed. After threshing and cleaning, guayule seed contains a considerable amount of foreign material (broken stems and leaves). It was found that water soaking for four hours changes

the density and consistency of this material so that most of it is removed by water floatation and by putting it through the fanning mill again. Germination percentages were best obtained by growing in the greenhouse and counting the seedlings. These percentages were lower than those obtained from a germinator but were more applicable to commercial use.

Publications: 84/01 to 84/12

RUBIS, D.D. 1984. Cultural practices and breeding methods for improved rubber yields in guayule. Presented at 5th Annual Meetings Guayule Rubber Society, June 17 - 21, 1984. Washington, D.C.

RUBIS, D.D. 1984. Guayule seed increase production and genetic materials development program. Special Report to USDA, SEA, Special Programs, July 15, 1984. Xerox Report 21 p.

RUBIS, D.D. 1984. Monthly harvests of five varieties of guayule to ascertain the seasonal effects on rubber accumulation. Progress Report to USDA Regional Project W-157, September 20, 1984. Riverside, California.

FANGMEIER, D.D., RUBIS, D.D., TAYLOR, B.B. and FOSTER, K.E. 1984. Guayule for rubber production in Arizona. Arizona Agricultural Experiment Station Tech. Bul. 252 14 p.

03.016 CRIS0082425
WATER USE AND PRODUCTION PRACTICES FOR GUAYULE

FANGMEIER D D; JOHNSON D L; Soil Water & Engineering; University of Arizona, Tucson, **ARIZONA** 85721.
 Proj. No.: ARZT-856708-G-21
 Project Type: NATIVE LATEX
 Agency ID: CSRS Period: 01 SEP 80 to 31 AUG 85

Objectives: Determine optimum irrigation method and water use for guayule and the effect of water stress on yield; compare procedures for establishment of guayule; determine the effects of herbicides, plant spacing, variety and soil fertility on plant growth and yield; and determine timing and method for harvesting guayule.

Approach: Field plots will be established using varieties, population and water levels as variables. Sprinkler and furrow irrigation will be used to evaluate procedures for stand establishment by direct seeding and transplanting. Plant samples will be collected and evaluated for growth and rubber yield with age and season.

Progress: 84/01 to 84/12. Guayule was transplanted in April and October 1980 near Litchfield Park west of Phoenix, Arizona. Four irrigation application depths ranging from 300 to 900 mm per year were applied to plots in a randomized block design. Shrubs were harvested in Winter 1982-83 and January 1984 and analyzed for dry matter, rubber production and resin production. Dry matter production increased with increasing water application and ranged from 11,000 to 18,500 kg/ha for the lowest to highest water depths, respectively. Rubber content decreased with increasing water with

the averages ranging from 5.0 to 3.5 percent for lowest to highest application depths, respectively. Rubber production after 3 years averaged 600 kg/ha and was reduced by soil compaction. Resin content averaged 850 kg/ha. Varieties N576 and 11591 had highest yields in the April planting, while N396 was highest in the October planting. Plants clipped 10 cm above the soil surface had about 70 percent survival but yields were low because soil compaction reduced plant growth.

Publications: 84/01 to 84/12

FANGMEIER, D.D., SAMANI, Z., GARROT, D. JR., and RAY, D.T. 1984. Water requirements of guayule for rubber production. Presented Amer. Soc. of Agr. Engrs. Mtg. Dec. 11-14, New Orleans, La.

FANGMEIER, D.D., RUBIS, D.D., TAYLOR, B.B. and FOSTER, K.E. 1984. Guayule for rubber production in Arizona. Tech. Bull. 252, Ariz. Agr. Exp. Sta., Univ. of AZ, Tucson, 14 p.

03.017 CRIS0048907
DIRECT SEEDING FOR ECONOMICAL GUAYULE RUBBER PRODUCTION

ROTH R L; BUCKS D A; Soil Water & Engineering; University of Arizona, Yuma, ARIZONA 85364. Proj. No.: 5422-20740-012-02S

Project Type: COOPERATIVE AGREE.

Agency ID: ARS Period: 30 SEP 83 to 30 SEP 86

Objectives: Evaluate techniques and irrigation water management practices for direct seeding of guayule seeds in the field.

Approach: Field investigations will be conducted in cooperation with the U.S. Water Conservation Laboratory, Phoenix, AZ, and the Seed Research Laboratory, Beltsville, MD. Initial planting practices to be investigated are raw seed, pelleted seed, fluid drilled seed, and preconditioned seed on a sandy soil at Yuma, AZ, along with different irrigation amounts applied by an automated, linear-move sprinkler system. Initial testing and conditioning of the seed lots will be accomplished by the Seed Research Laboratory. Some of the field measurements will include soil temperatures, soil moisture, water applied, and plant survival rates for the various treatments.

Progress: 83/09 to 83/12. Investigation on the direct seeding of guayule was started to improve the economics of plant establishment. Seed treatment included the use of gibberillic acid, pelleting, and priming with polyethylene glycol. Combinations of these plus the use of better fluid drilling and irrigation techniques improved germination and plant survival over conventional methods during the three-month establishment period. Low soil temperatures and high moisture conditions, which causes the slowing of seedling growth and promote soil pathogens, respectively, reduced plant establishment. Control of disease using pre-plant soil fungicide and fumigant treatments was mixed. Competition from the faster growing weed was also a problem.

Publications: 83/09 to 83/12
NO PUBLICATIONS REPORTED THIS PERIOD.

03.018 CRIS0044206
BIOREGULATION OF YIELD AND QUALITY OF RUBBER IN GUAYULE (PARTHENIUM ARGENTATUM)

YOKOYAMA H; HSU W J; Agricultural Research Service, Pasadena, CALIFORNIA 91106. Proj. No.: 5311-20560-001-00D

Project Type: INHOUSE

Agency ID: ARS Period: 07 DEC 77 to 07 DEC 86

Objectives: Investigate the regulation of rubber biosynthesis in guayule with the aim of developing methods to optimize the yield and enhance the quality of the rubber through the action of bioregulatory agents that stimulate and direct rubber biosynthesis.

Approach: Design and synthesize bioregulators that stimulate and direct rubber biosynthesis in guayule plants. Study the structure-activity relationships and based on the results develop improved bioregulators. Investigate the mode of action of bioregulators using whole plants and tissue cultures. Compare the effectiveness of the bioregulators by treating plants under controlled conditions and in the field. Determine the conditions for optimum effectiveness of the bioregulators by studying such factors as varietal differences, photosynthetic efficiency, bioregulator concentration and time of application and influence of stress conditions and dormancy. Study cell suspension (fermentation process) for production of rubber in the presence of bioregulators.

Progress: 83/01 to 83/12. The response of guayule plants to bioregulators is influenced by cultivar differences. Cultivar 11634, for example, responds optimally to DCPTA as determined by the increase in rubber synthesis. This may be due to differences in ease of penetration of the bioregulators into the plant tissue. The mode of action of these bioregulators appears to be in the regulation of transcription of the regulatory gene. DCPTA causes the bioinduction of the key enzymes involved in rubber synthesis in the guayule plant. These enzymes are mevalonic acid pyrophosphate kinase, isopentenylpyrophosphate isomerase, and rubber transferase. DCPTA also causes the bioinduction of farnesyl pyrophosphate synthetase indicative of influence on the triterpenoid pathway. There appears to be a general effect on the plant.

Publications: 83/01 to 83/12

HAYMAN, E., YOKOYAMA, H., and GOLD, S. 1983. Effect of bioregulators on the accumulation of rubber in guayule. J. Agricultural and Food Chemistry. 31:1120.

BENEDICT, C., REIBACH, P.H., MADHAVAN, S., STIPANOVIC, R.V., KEIHLY, J.H., and YOKOYAMA, H. 1983. Effect of 2-(3,4-dichlorophenoxy)-triethylamine on the synthesis of cis-polyisoprene in guayule plants (*Parthenium argentatum* Gray).

YOKOYAMA, H., HSU, W.J., HAYMAN, E., and POLING, S. 1983. Bioregulation of rubber synthesis in the guayule plant. In Plant Growth Regulating Chemicals. Ed. by L. G. Nickell, Volume I, pp 59-70, CRC Press, Cleveland, Ohio.

YOKOYAMA, H., HAYMAN, E., HSU, W.J., and POLING, S. 1983. Bioregulators and rubber synthesis in the guayule plant. ACS Symposium on Effect of Bioregulators on Agricultural Crops. Aug. 28-Sept. 2. Washington, D.C. Abstract.

03.019 CRIS0082631
OPTIMIZE RUBBER PRODUCTION IN GUAYULE BY BREEDING AND SELECTION

TYSDAL H M; SIDDIQUI I A; Plant Industry; Calif Dept of Food and Agri, Shafter, CALIFORNIA 93263.
 Proj. No.: CALA-2-146-0

Project Type: NATIVE LATEX
 Agency ID: CSRS Period: 01 SEP 80 to 31 AUG 83

Objectives: To optimize rubber production in guayule, *Parthenium argentatum*, by breeding and selection; to evaluate and select new varieties for disease resistance and cold tolerance; and to optimize rubber production in new varieties through the use of bioregulators.

Approach: This crash breeding program will combine three approaches: selection within sexually reproducing 36 chromosome diploid guayule; interspecific hybridization; and crosses with selected apomictic guayule to "fix" the desired genotypes to produce an improved, higher rubber-yielding variety or varieties, which will breed true to type.

Progress: 82/09 to 83/08. Three approaches, namely selection among apomictic plants, hybridization of guayule to its tree-like related species followed by several generations of backcrossing, and recurrent selection among sexual diploids, have been used to achieve the primary objective of the project which is developing guayule varieties with increased rubber yield. In a preliminary comparison, our selections C254 and C250 produced 62 and 36% more rubber yield than variety 11605 as early as 9 months after the transplanting date. Seeds from these selections as well as other promising selections have been made available to the five public institutions involved in the Uniform Regional Variety Trials for early observations and evaluations and to Professor S. M. Alcorn of the University of Arizona whose preliminary testing indicates that C254 also ranks high for its resistance to *Verticillium* wilt. Detailed comparisons of the promising selections with the check varieties will be available later from our new replicated planting established at Shafter in March 1983. In the area of the interspecific hybridization 1,540 F(2) and BC(1) plants derived from crossing guayule to *P. tomentosum* var. stramonium and *P. fruticosum* were analyzed in the winter of 1983 and were found to range from 0 to 16% in their rubber content. Eighty-two of these plants were selected and removed from the McFarland, California nursery and were

interplanted among selected guayule plants in an isolation plot at Shafter to achieve natural backcrossing.

Publications: 82/09 to 83/08

TYSDAL, H.M. ESTILAI, A., KNOWLES, P.F. and SIDDIQUI, I.A. 1983. New promising guayule selections with increased yield. Fourth Annual Conference of the Guayule Rubber Society, 20-23 June. Riverside, CA.

TYSDAL, H.M., ESTILAI, A., SIDDIQUI, I.A. and KNOWLES, P.F. 1983. Registration of four guayule germplasms. *Crop Sci.* 23:189.

ESTILAI, A., TYSDAL, H.M. and KNOWLES, P.F. 1982. Variability for rubber content in diploid guayule and its utilization in early selection. *Agron. Abstracts.*

ESTILAI, A., TYSDAL, H.M., KNOWLES, P.F. and SIDDIQUI, I.A. 1983. Variability for rubber content in the segregating generations of guayule interspecific hybrids. Fourth Annual Conference of the Guayule Rubber Society, 20-23 June.

ESTILAI, A., HASHEMY, A. and YOUNGNER, V. 1983. Genomic relationship of guayule with *Parthenium schottii*. Fourth Annual Conference of the Guayule Rubber Society, 20-23 June. Riverside, CA.

03.020 CRIS0046102
BIOREGULATION OF RUBBER IN GUAYULE

HAYMAN E; YOKOYAMA H; California Arboretum Foundation, Arcadia, CALIFORNIA 91006.
 Proj. No.: 5211-20560-002-00A

Project Type: CONTRACT
 Agency ID: ARS Period: 31 MAR 80 to 30 SEP 84

Objectives: Investigate the mode of action and metabolic fate of bioregulators that stimulate rubber accumulation in guayule.

Approach: Treat guayule plants and tissues thereform with bioregulators under controlled conditions. Determine the effect of the bioregulations on rubber accumulation. Correlate with changes in the biochemistry of the polyisoprenoid pathway and with changes in stem anatomy and subcellular components. Identify metabolic products of labeled bioregulators.

03.021 CRIS0091743
OPTIMIZE RUBBER PRODUCTION IN GUAYULE BY BREEDING AND SELECTION

ESTILAI A; Agronomy & Range Science; University of California, Davis, CALIFORNIA 95616.

Proj. No.: CA-D*-ARS-4393-SG

Project Type: NATIVE LATEX
 Agency ID: CSRS Period: 15 SEP 83 to 30 SEP 84

Objectives: The primary objective is to develop new guayule plants with increased rubbercontent. Other objectives include identification and evaluation of genotypes with increased resistance to diseases, pests and

unfavorable environments; development of optimum production practices for superior genotypes; evaluation of bioregulators that will increase rubber contents; determination of the association of chromosome number with apomixy and plant performance.

Approach: Three approaches will be used in breeding for increased rubber yield. They include: Selection among apomictic plants followed by hybridization of the superior types; interspecific hybridization of guayule to its tree-like related species in order to utilize their desirable characteristics such as disease resistance, cold tolerance and high biomass production; recurrent selection among sexual diploid plants in order to accumulate and increase the frequency of the genes affecting rubber production. The flotation method (blender method), which is fast and allows the screening of a large number of plants economically, will be used in the analysis of rubber content.

Progress: 83/09 to 84/09. Three approaches, namely selection and hybridization among apomictic plants, hybridization of guayule to its tree-like relatives followed by several generations of backcrossing of the F(1S) to the guayule parent, and recurrent selection among sexual diploids, are being used to achieve our primary objective which is developing guayule varieties with increased rubber yield. Two of our selections, C254 and C250, that out-yielded variety 11605 by 62 and 36% at the age of nine months, maintained their superiority over 11605 at the age of 21 months. They out-yielded 11605 by 51 and 22% in a preliminary yield test conducted in February 1984. During 1984 sufficient mounts of seed were collected from those selections and were distributed to the institutions involved in the Uniform Regional Variety Trials to be planted in the spring of 1985 for further testing. In the area of interspecific hybridization, a new germplasm, Cal-5, was released in 1984. This new germplasm combines the rubber bearing capability of guayule with two desirable traits of *Parthenium tomentosum* var. *stramonium*, namely resistance to *Verticillium* wilt and high biomass production. Promising F(3S) and BC(2S) derived from interspecific hybridizations were planted at Shafter, CA in May 1984 for further evaluation. In the area of recurrent selection of the diploids, seeds obtained from the selected base population were planted in 1984 to start a new cycle of selection.

Publications: 83/09 to 84/09

- ESTILAI, A. 1984. Inheritance of flower color in guayule. *Crop Sci.* 24:760-762.
- ESTILAI, A. 1985. Registration of Cal-5 guayule germplasm. *Crop Sci.* (In press).
- ESTILAI, A. and YOUNGNER, V.B. 1984. Plant breeding for increased guayule rubber yields. *Proceedings of the Fifth Annual Conference, Guayule Rubber Society*, pp. 35-40.
- ESTILAI, A. 1984. Comparison of new guayule selections with varieties N565 and 11605 for their rubber yield. *Proceedings of the Fifth Annual Conference, Guayule Rubber Society*, p. 74.

ESTILAI, A. and HASHEMI, A. 1984. Interspecific hybridization between guayule and its tree-like relatives. *Agronomy Abstracts*, p. 64.

03.022*

CRIS0081673

DEVELOPMENT OF NEW AND IMPROVED CROPS FOR WATER CONSERVATION IN ARID LANDS

RAINS D W; Agronomy & Range Science; University of California, Davis, CALIFORNIA 95616.

Proj. No.: CA-D*-ARS-3983-RR Project Type: HATCH
Agency ID: CSRS Period: 01 OCT 79 to 30 SEP 86

Objectives: Evaluate species of *Curcifer* which will produce useful products under minimum water regimes and develop effective production practices for such species. Breed improved cultivars of guayule (*Parthenium argentatum*) having a high rubber content (15-20%) and develop economical cultural and harvesting procedures with emphasis on growing guayule under minimum water regimes.

Approach: Cruciferous species: Evaluate superior introductions of cruciferous species including *Brassica campestris*, *B. napus*, *B. juncea*, *B. carinata*, *B. nigra*, *B. hirta*, *Crambe abyssinica* and *Eruca sativa* for yield, seed oil content, fatty acid composition of the oil, other plant characters and resistance to pests. Conduct tests of fertilizers, herbicides and rates and dates of seeding. Initiate a breeding program to develop better adapted genotypes. Guayule: Test strains, herbicides, fertilizer treatments and irrigation treatments. Initiate a breeding program.

Progress: 84/01 to 84/12. Brassica species. Twenty one lines of *B. juncea* and *B. carinata* were released for distribution to breeders and geneticists. Disease free lines will be maintained by the Dept. of Plant Pathology, University of Wisconsin (Paul Williams). Four rep yields tests were planted at two sites in Yolo county; primarily of advanced lines of *B. campestris* but also including *B. juncea* and *B. nigra*. *B. campestris* lines will also be evaluated spring planted in Saskatoon. Lupinus species. Cooperative extension trials of sweet cultivars of *L. albus* were planted at 12 locations in seven counties; primarily for seed production but also for forage mix provided for cooperative research with Environmental Toxicology on alkaloid metabolism in dairy cows (Crosby) and one ton lots of 1985 harvested seeds will be given to Avian Sciences for poultry feeding studies (Vohra). Seed was provided for N(2) fixation and cultural practices studies at UC Davis (Cassman). Evaluation of lupine diseases at all locations will begin this Spring (Buddenhagen).

Publications: 84/01 to 84/12

- COHEN, D.B. and KNOWLES, P.F. 1984. Release of Brassica germplasm from UC Davis. *Crucifer Genetics Newsletter*, Fall.

03.023 CRIS0091355
SALINE GROUNDWATER IRRIGATION TO REVERSE
DESERTIFICATION

ROBINSON F E; Land, Air & Water Resources;
University of California, Davis, CALIFORNIA
95616.

Proj. No.: CA-D*-LAW-4386-SG

Project Type: SPECIAL GRANT

Agency ID: CSRS Period: 15 SEP 83 to 30 SEP 86

Objectives: Determine an efficient irrigation and cultural management of jojoba, guayule, olive, sugar beet, tamarisk, and barley utilizing saline ground water to reverse desertification. Monitor the moisture stress cycle of *Larrea tridentata* and *Palafoxia linearis*.

Approach: Utilizing sprinkler, spray, and biwall tubing with 1,430 mg/L TDS water for irrigation and using organic and chemical fertilizers with subsurface soil tillage to establish crops, monitor the plants with a soil neutron probe, an infrared thermometer correlation to Class A USWB pan to develop an efficient cultural technique for an arid desert.

Progress: 84/01 to 84/12. A moisture stress index for sugar beets was developed utilizing an infrared gun, a hand held anemometer, and a sling psychrometer. In sandy desert plots on the Imperial East Mesa, the index was used to record significant stress difference between plants which had been grown in single vs double rows in biwall irrigated lines and between plots which had received subsoil disturbance and those which remained undisturbed. Neutron moisture probe access tubes were installed on olive, guayule, and sugar beet plants to observe moisture changes in the root zone. Indices of moisture stress for several plant species are under development. Biwall, spray, and sprinkler irrigation have been shown to be effective irrigation methods with water having 750 mg/L chlorides and 1430 mg/L total dissolved solids when used on sands. Where low quality water is available in areas of desertification, salt tolerant crops can be supported with these methods.

Publications: 84/01 to 84/12

ROBINSON, F.E. 1984. Agricultural development of an arid sandy desert with saline irrigation in a geothermal well area. Proceedings of the International Symposium on Recent Investigations in the Zone of Aeration. Ed. P. Udluft, B.

ROBINSON, F.E. 1984. Infrared analysis of sugar beet moisture stress due to root restriction and population. Agronomy Abstracts. 76th Annual Meeting, Las Vegas. Amer. Soc. Agronomy. p. 17. November.

03.024 CRIS0080420
DEVELOPMENT OF NEW AND IMPROVED CROPS FOR WATER
CONSERVATION AND ARID LANDS

COGGINS C W; MURASHIGE T; ROOSE M L; Botany & Plant Sciences; University of California, Riverside, CALIFORNIA 92521.

Proj. No.: CA-R*-BPS-3898-RR Project Type: HATCH
Agency ID: CSRS Period: 01 OCT 79 to 30 SEP 85

Objectives: Breed improved cultivars of guayule (*Parthenium argentatum*) having a high rubber content (15-20%), and develop economical cultural and harvesting procedures with emphasis on growing guayule under minimum water regimes. Domesticate jojoba, (*Simmondsia chinensis* (Link) Schneider) including the development of improved varieties, to establish efficient production and harvesting techniques under minimum water regimes, and conduct economic feasibility studies. Improve guar (*Cyamopsis tetragonoloba*) production under minimum water regimes through the development of high-yielding varieties adapted to such conditions and identify efficient production practices for this species. Identify efficient exploratory research, additional plant species which hold promise for good performance under saline and limited water regimes.

Approach: Conduct breeding and agronomic research on guayule, jojoba, and guar and conduct exploratory research as specified in the procedures section of project W-157.

Progress: 84/01 to 84/12. Guayule - Agronomic Studies. Hybrids between *Parthenium argentatum* and the 3 tree-like species (*P. schottii*, *P. fruticosum*, *P. tomentosum*) are mostly intermediate in morphology and biomass. Rubber quantity is also intermediate, but they inherited high molecular weight rubber. F(2)'s and backcrosses are being evaluated. 20 USDA guayule lines showed significant differences in rubber content between and within most lines. The high-rubber selections are being increased for further evaluation. Second-cycle cold tolerant guayule plants at Palmdale with high-rubber were identified and will be further increased and evaluated. Cold tolerance is also being incorporated into guayule by hybridization with *P. alpinum*, and other northern species. Guayule - Tissue Culture. Protoplasts were prepared enzymatically from cultured shoots and leaves of *P. argentatum*, with yields near 1 million cells per gram of 3-day-old cultures. Also established were tissue cultures of 2 low rubber producing, but rapidly growing species, *P. confertum* and *P. bipinnatifidum*. Parasexual hybridization between these and *P. argentatum* is being attempted through protoplast fusion. Jojoba. A strain of jojoba was developed that has 62% oil content. This represents a 20% increase in oil since all commercially available materials now have 50-52%. The new strain has additional desirable characteristics.

Publications: 84/01 to 84/12

HASHEMI, A, WEST, J.E. and YOUNGER, V.B. 1984. Pollen fertility and chromosomal pairing in guayule interspecific hybrids. 5th Ann. Guayule Rubber Soc. Conf., Washington, D.C., June 18-21, 1984.

(Summary)

NAQVI, H.H., KHAIR, M. and YOUNGER, V.B. 1984. Breeding potential of variability in rubber and resin contents among guayule lines at the University of California, Riverside. 5th Ann. Guayule Rubber Soc. Conf., Washington, D.C.

NAQVI, H.H., DAVEY, J., YOUNGER, V.B., FLORES, G. and RODRIGUEZ, E. 1984. Interspecific hybridization in *Parthenium*. 5th Ann. Guayule Rubber Soc. Conf., Washington, D.C., June 18-21, 1984. (Summary)

NAQVI, H.H. and YOUNGER, V.B. 1984. Guayule-A rubber plant resource of the US-Mexico borderlands. In Ganster, P. and H. Walters (eds.), Proc. UCLA Borderlands Environ. Conf., Sept. 11-14, 1983, UCLA Latin American Center.

03.025 CRIS0056334
BIOSYSTEMATICS AND SELECTED CHEMICAL CONSTITUENTS IN THE RATACEAE AND OTHER PLANT TAXA

SCORA R W; KUMAMOTO J; Botany & Plant Sciences; University of California, Riverside, CALIFORNIA 92521.
Proj. No.: CA-R*-BPS-2582 Project Type: STATE
Agency ID: SAES Period: 01 OCT 83 to 30 SEP 88

Objectives: Determine taxonomic relationships; develop better means of identification; develop more precise and useful terminology; use chemo-taxonomic data to predict horticultural performance; find chemical markers which are a) useful in breeding, b) can be included in plant patent descriptions, c) give clues to origin of plant; determine presence of any desirable specialty chemicals.

Approach: Numerical analysis of Rutaceous affinities using morphological, anatomical, chemical characteristics--latter by GC of terpenes; column chroma and GC of alkanes; paperchro and HPLC of flavanoids; electrophoresis of isozymes. Analysis of biotypes of cultivated citrus, close relatives, interspecific, intergeneric hybrids, clones of unknown parentage. Analysis of wild growing plants for spec. chemical studies.

Progress: 84/01 to 84/12. The study of terpene constituents of *Chrysothamnus nauseosus* as a possible alternate to *Parthenium*, as well as its structural determinations, are continuing. Phenolic data of various species of *Citrus* are being investigated for a diagram of species relationships. Historical data on the grapefruit have been compiled and submitted for publication. Isozyme studies of many *Citrus* species have been studied in an investigation to elucidate the taxonomic position of *Citrus halimii*. The study of terpenes of 6 species of the genus *Parthenium* has been completed and submitted to the J. of Agric. Food Chem. for publication. Presentations were given at the 5th. Annual Conference of the Guayule Rubber Soc. in Washington, D.C. and at the Annual AIBS Meeting at Ft. Collins, CO. I have participated in the 1984 IBPGR Citrus Germplasm collection in Thailand, West and East Malaysia, and

Brunei. Seeds, budwood, and pollen have been collected and will be available to UCR after release from Tsukuba.

Publications: 84/01 to 84/12

SCORA, R.W., KUMAMOTO, J., HORNER, P.F. and HOLLENBERG, J.L. 1984. Ontogenetic variation and diurnal study in the composition of essential oils in *Arthemina douglasiana* Bess. J. Nat. Prod. 47:279-284.
KUMAMOTO, J. and SCORA, R.W. 1984. The identification of bornyl acetate in the leaf oil from *Parthenium argentatum* A Grey. J. Agr. Food Chem. 32:418-420.

03.026 CRIS0056332
GENOME MODIFICATION OF AGRONOMIC AND HORTICULTURAL CROPS

WAINES J G; Botany & Plant Sciences; University of California, Riverside, CALIFORNIA 92521.
Proj. No.: CA-R*-BPS-2580 Project Type: STATE
Agency ID: SAES Period: 01 JUL 84 to 30 SEP 89

Objectives: Modify genomes of crop plants to improve adaptation to physical, biological, and economic stresses. The genetics and breeding of cereals, legumes, guayule, cotton, and ornamentals will be undertaken.

Approach: Collect, store, evaluate germplasm; study breeding system and evolution. Subject germplasm to desired stresses. Investigate genetics and biochemistry of characters. Transfer genes to desired germplasm using appropriate techniques. Test segregating populations to check that gene(s) has been transferred in laboratory and field.

Progress: 84/01 to 84/12. This project revised as of July 1, 1984 under new title "Genome Modification of Agronomic and Horticultural Crops." Interspecific hybrid selections of common beans and tepary beans were tested for resistance to heat, drought, lesser cornstalk borer and *Macrophomina*. Promising lines were carried forward to next year. Cold tolerance at emergence was tested in common beans and teparies. Tepary germplasm was increased in the field and greenhouse. The free threshing gene of *Triticum monococcum* var. *sinskajae* was transferred to selected lines of diploid wheats. Two accessions of diploid T. *monococcum* had good flour yields and exhibited good cookie diameters in appropriate tests. The 2RL-2AS(2A) rye/wheat substitution exhibited larger loaf volume than the Chinese Spring bread wheat parent. *Salvia* species were selected for types able to grow under minimal watering and maintenance.

Publications: 84/01 to 84/12

WAINES, J.G. 1983. Genetic variation in diploid wheats: the case for diploid commercial wheats, p. 115-122. In Sakamoto, S. (ed.), Proc. 6th Int. Wheat Genet. Symp., Kyoto, Japan, 1983.
GILL, B.S., BROWDER, L.E., HATCHETT, J.H., HARVEY, T.L., MARTIN, T.J., RAUPP, W.J., SHARMA, H.C. and WAINES, J.G. 1983. Disease and insect resistance in wild wheats, p.

- 785-792. In Sakamoto, S. (ed.), Proc. 6th Int. Wheat Genet.
- LAHSAIEZADEH, M., TING, I.P. and WAINES, J.G. 1983. Drought resistance in Chinese Spring wheat/imperial rye addition and substitution lines, p. 945-950. In Sakamoto, S. (ed.), Proc. 6th Int. Wheat Genet. Symp., Kyoto, Japan, 1983.
- THOMAS, C.V. and WAINES, J.G. 1984. Fertile backcross and allotetraploid plants from crosses between tepary beans and common beans. *Journal of Heredity* 75:93-98.
- ZIMMERMAN, M.J.O., ROSIELLE, A.A. and WAINES, J.G. 1984. Heritabilities of grain yield of common bean in sole crop and intercrop with maize. *Crop Science* 24:641-644.

03.027 CRIS0088985
BREEDING GUAYULE FOR INCREASED RUBBER YIELD

WAINES J G; Botany & Plant Sciences;
 University of California, Riverside, **CALIFORNIA**
 92521.

Proj. No.: CA-R*-BPS-4284-SG

Project Type: NATIVE LATEX

Agency ID: CSRS Period: 15 JUL 82 to 31 AUG 84

Objectives: Develop improved guayule (*Parthenium argentatum*) varieties with high rubber yields. Specific objectives are higher rubber content, large plant size, fast growth rate, prolific branching, disease tolerance, high water use efficiency, cold tolerance, salinity tolerance and seedling vigor.

Approach: Expand germplasm bank with new collections of guayule and other *Parthenium* species. Hybridize guayule with other species. Select desirable types in backcross, F(2) and later segregating generations. Select desirable types within guayule and recombine through hybridization. Study selections cytologically. Analyze biochemically for rubber, resins and other constituents. Investigate bioregulators to increase rubber content. Tissue culture studies for rapid clonal propagation and selection.

Progress: 82/07 to 84/08. The guayule breeding project at UCR is aimed at developing guayule (*Parthenium argentatum* Gray) as a commercial rubber-producing crop for the arid southwest. Research is focused on three areas: (1) single-plant selections from amongst the existing, highly variable apomictic guayule germplasm; (2) interspecific hybridization with other *Parthenium* species having desirable characteristics; and (3) chemical and cytological studies to understand the inheritance of rubber, and other useful traits in the newly developing taxa. Significant progress has been made during the past two years. Hundreds of hybrids have been made with the three high-biomass species. Most of these hybrids are very vigorous and have inherited good quality rubber. Hybrids with northerly species are being evaluated for their cold-tolerance characteristics. Screening work is under way to understand the extent of variability in the existing guayule germplasm, and to identify high-rubber-yielding plants for new germplasm releases. Some of these

selections are now in the second cycle of testing and are fairly uniform in morphology and rubber content. Since most of these selections are from apomictic parents, differences in rubber content may prove heritable and some may prove to be better strains. Our studies of the chemistry, cytogenetics, and aseptical propagation have also met with a fairly high degree of success.

Publications: 82/07 to 84/08

- NAQVI, H.H., and YOUNGNER, V.B. 1984. Guayule-A rubber plant resource of the US-Mexico border-lands. In Ganster, P. and H. Walters (eds.), Proc. UCLA Borderlands Environ. Conf., Sept. 11-14, 1983, UCLA Latin American Center.
- NAQVI, H.H., YOUNGNER, V.B. and RODRIGUEZ, E. 1984. Inheritance of rubber and botanical traits in F(1) hybrids between *parthenium argentatum* and *P. schottii*. *Bull. Tor. Bot. Club.* 111(03):377-382.
- NAQVI, H.H. 1984. Rubber quantity and quality considerations in guayule breeding. *El Guayulero* 6(1, 2):6-13.
- YOUNGNER, V.B., NAQVI, H.H., WEST, J. and HASHEMI, A. 1984. *Parthenium* species of potential use in the improvement of guayule, *Parthenium argentatum*. *J. Arid Environ.* (in press)

03.028 CRIS0093819
GUAYULE BREEDING AND DEVELOPMENT

WAINES J G; Botany & Plant Sciences;
 University of California, Riverside, **CALIFORNIA**
 92521.

Proj. No.: CA-R*-BPS-4489-SG

Project Type: NATIVE LATEX

Agency ID: CSRS Period: 15 JUN 84 to 30 JUN 86

Objectives: Develop improved guayule varieties with high yields of high-quality rubber. Specific objectives are higher yields of high-quality rubber, cold tolerance, seedling vigor, disease resistance, salinity tolerance, high water use efficiency.

Approach: Expand UCR germplasm bank of guayule and other *Parthenium* species. Assay for increased rubber quantity and quality. Hybridize, backcross, and select guayule populations. Determine cytogenetic relationships. Analytically determine rubber quantity, quality, resin content. Evaluate selections for rubber and biomass production, for direct seeding and harvesting, and for tolerance to various stresses.

Progress: 84/07 to 84/12. Examination of 2300 F(2) and BC(1) plants from guayule X *P. tomentosum* revealed that these high-biomass plants did not contain rubber at the age of 9-15 months, but showed rubber concentration of 1-8% at 2 years. Advance generation of hybrids were developed in greenhouse and field. In the selection area, several hundred apomictic guayule plants were screened at Shafter, Riverside, and Palmdale for rubber content, and the top selections were included in the observation plots. Open-pollinated seed from the high-rubber diploid guayule selections were

included in a new recurrent selection program. A new release Cal-5 was made that combines the rubber-producing capability of guayule with high biomass production and the wilt-tolerance of *P. tomentosum*. Two superior guayule selections i.e. C-250 and C-254 were added to the variety trial program. Rubber molecular weight determinations, cytogenetics investigations, and other activities were continued. Year 2 samples from the Uniform Regional Variety Trials were collected and analyzed for rubber, resin, and moisture contents. Seed harvested at Salinas, California resulted in the availability of USDA lines N565, N576, 11591, 11605, 11604, and 11619, for storage.

Publications: 84/07 to 84/12

ESTILAI, A. and HASHEMI, A. 1984.

Interspecific hybridization between guayule and its tree-like relatives. 76th Amer. Soc. Agron. Mtgs., Las Vegas, NV., Nov. 25-30, 1984.

NAQVI, H.H., DAVEY, J. and WAINES, J.G. 1984.

Guayule breeding for improved biomass and rubber production. 76th Amer. Soc. Agron. Mtgs., Las Vegas, NV., Nov. 25-30, 1984.

03.029 CRIS0062810
UTILIZATION, CONVERSION, AND MANAGEMENT OF SOUTHERN CALIFORNIA BRUSHLAND

YOUNGNER V B; NUDGE F J; Botany & Plant Sciences; University of California, Riverside, CALIFORNIA 92521.

Proj. No.: CA-R*-BPS-2861-H Project Type: HATCH
Agency ID: CSRS Period: 03 OCT 72 to 31 MAR 84

Objectives: Develop a basis for brushland utilization and management through studies on potential uses of brush species, effects of harvesting methods, substitution of exotic species, seedling establishment, competition among native and exotic species, physiology of resprouting.

Approach: Through field, greenhouse, growth chamber, and laboratory studies. Field studies will be in natural brushlands and field plantings, using portable research equipment. Laboratory analyses to plant tissue constituents and soil properties will be correlated with field observations. Specific environmental responses will be studied in greenhouse and growth chambers.

Progress: 84/01 to 84/03. Investigations of annual range plant responses to the air pollutants O₃ and SO₂ were conducted in fumigation chambers. In *Bromus rubens* ozone both reduced yield and affected several aspects of quality. Sulfur dioxide effects were less and primarily involved quality factors. Interaction of the two pollutants was not shown. Chronic SO₂ exposure of *Bromus mollis* and *Erodium botrys* also resulted in yield reductions with carbohydrate allocation to the root zone being significantly reduced in *B. mollis*. *Erodium* growth showed some stimulation at the low SO₂ level but not at higher levels. Shoot sulfur content in *Bromus* was higher than in *Erodium* at comparable fumigation

levels. Detrimental effects of fumigation were often not immediately apparent but developed as the season progressed. These studies indicated that air pollutants affect growth of brushland plants and may change species composition in affected areas. In some regions of high pollutant levels, value of the vegetation for forage and erosion control may be impaired and type conversion to species shown to be more tolerant may be desirable. Preparation of data for formal publication has continued.

Publications: 84/01 to 84/03

NO PUBLICATIONS REPORTED THIS PERIOD.

03.030

CRIS0044872

HYDROCARBON-PRODUCING PLANTS AS POTENTIAL MULTI-USE CROPS

CARR M E; ROTH W B; Biomaterials Conversion Lab; Northern Regional Res Center, Peoria, ILLINOIS 61604.

Proj. No.: 3620-20561-001-00D

Project Type: INHOUSE

Agency ID: ARS Period: 13 DEC 78 to 30 SEP 88

Objectives: Identify plant species high in phytochemicals and high in biomass productivity, select the more promising species for further study as potential crop sources of critical or strategic materials, fully characterize their constituents, develop practical methods for recovering the valuable constituents, and evaluate the most promising species for potential as crops.

Approach: Continue basic analytical and botanical evaluation of additional species for a total of about 1500. Select species with unusually high proportions of oil, polyphenol, hydrocarbon, and protein and with highly desirable botanical characteristics. Characterize major components of select species to identify species most valuable for potential new crop sources of fuels, chemicals, feedstocks, feed, fiber, and critical materials. Develop practical methods to separate, recover, rapidly analyze, and determine the value of plant constituents. Determine the response of highly select species to hormones, stimulants, and environment. Recommend species for genetic improvement and agronomic studies.

Progress: 83/01 to 83/12. Whole-plant specimens of 625 species were collected. Of these, 350 were evaluated for their potential as energy-producing crops. Oil and hydrocarbon from 85 selected species were partially characterized for lipid classes, for yields of fatty acids and unsaponifiable matter, for rubber, gutta, and/or waxes in hydrocarbon by IR and ¹³C NMR, and for MW and MW distribution of rubber and gutta by GPC. Of the 350 species 35 were identified for future study. Promising species yielded as much as 10% oil (*Pinus albicaulis*), 26% polyphenol (*Acer ginnala*), 2.3% hydrocarbon (*Pittosporum tobira*), and 23% apparent protein (*Verbesina encelioides*), on a dry, whole-plant basis. Two new sources of gutta were discovered (*Garrya flavescens* and *G. wrightii*). A GPC technique was developed to

quantitate rubber. For a heritability study, 78 leaf samples of *Asclepia syriaca* were analyzed for oil, polyphenol, hydrocarbon, and protein. For 12 USDA plant scientists, 625 sugar crop samples (1982 harvest) were analyzed for sugars and 580 samples (1980 harvest) for lignin and cellulose. Five species in 25-pound quantities were collected for gasification and biomass quality study for a cooperating university. Hydropulping studies of oil- and hydrocarbon-producing plants (e.g., milkweed, guayule, and sunflower) after solvent extraction were conducted to enhance their multipurpose usefulness.

Publications: 83/01 to 83/12

CARLSON, K.D., CUNNINGHAM, R.L., and HERMAN, A. I. Sweet sorghum grown on sludge-amended stripmine soil: A preliminary look at yields, composition, and ethanol production. Trans. 111. State Acad. Sci., in press.

CARLSON, K.D., CARR, M.E., CUNNINGHAM, R.L., BAGBY, M.D., and PALMER, D.M. Lignin analyses on sweet sorghum samples. Trans. 111. State Acad. Sci., in press.

03.031 CRIS0047260
RECOVERY OF RUBBER FROM GUAYULE AND RELATED WHOLE PLANT MATERIALS

HAMERSTRAND G E; BLACK L T; Biomaterials Conversion Lab; Northern Regional Res Center, Peoria, **ILLINOIS** 61604.

Proj. No.: 3620-20560-011-00D

Project Type: INHOUSE

Agency ID: ARS Period: 19 AUG 81 to 19 AUG 86

Objectives: Establish processing technologies, develop pilot procedures, and determine technical and economic feasibility of extracting or separating rubber, resins, and useful by-products from guayule and other whole plant materials.

Approach: Develop standardized analytical methodology for determining the quantity and quality of rubber in whole plant materials for use in in-house developmental studies and cooperative studies with other governmental agencies. The solvent extraction method developed at NRRC will be evaluated for applicability to pilot and eventually commercial utilization. Each step (cleaning, leaf removal, chopping, flaking or extrusion, acetone extraction, hexane extraction and solvent recovery) will be examined separately and modified as needed; equipment will be selected; and individual components will be integrated into a pilot facility (capacity 50-100 lbs. plant material/day). Concurrent studies will be undertaken on effects of storage of whole plant materials, by-product utilization, and efficacy of supercritical fluids for separating the various components of whole plant materials.

Progress: 83/01 to 83/12. A gravimetric method developed at NRRC in cooperation with the Water Laboratory in Phoenix, AZ was selected as the Standard Method of the Guayule Rubber Society for determining the resin and

rubber content in guayule. A computer assisted near infrared spectrophotometer has been successfully programmed to quantitatively measure the rubber and resin, as well as the moisture content, of ground whole-plant material. Analysis time has been reduced from the approximately 1 hour per sample required in the gravimetric procedure to less than 1 min in the instrumental method allowing rapid screening of the large number of samples being generated in agronomic studies. Rubber quality, as measured by molecular weight (M.W.) was found to be very sensitive to storage conditions. In ground samples stored at temperatures typical of those encountered in the South West (100+ F) the M.W. declined as much as 50% in a 24 hour period. Freezing the samples prevented appreciable decreases in M.W. during storage. Solvent to plant material ratios, feed rates, process temperatures, and contact times were evaluated in pilot-trials in conventional countercurrent oilseed extraction equipment for the continuous extraction of both the resin and rubber components from guayule and milkweed with a dual solvent (acetone then hexane) system.

Publications: 83/01 to 83/12

BLACK, L.T., HAMERSTRAND, G.E., NAKAYAMA, F.S., and RIANIK, B.A. 1983. Gravimetric analysis for determining the resin and rubber content of guayule. Rubber Chem. Technol, Vol. 56:367-371.

HAMERSTRAND, G.E. and MONTGOMERY, R.R. Pilot-scale guayule processing using countercurrent solvent extraction equipment. Rubber Chem. Technol. In press.

03.032 CRIS0048199
STUDY OF GUAYULE (PARTHENIUM ARGENTATUM) SEED DORMANCY

CHANDRA G R; Seed Research Lab Plant Genetics & Germplasm Inst; Beltsville Agr Res Center, Beltsville, **MARYLAND** 20705.

Proj. No.: 1208-20583-010-00D

Project Type: INHOUSE

Agency ID: ARS Period: 09 MAR 83 to 09 MAR 88

Objectives: Study dormancy of guayule (*Parthenium argentatum*) seeds and develop processing (conditioning) technology needed to free achenes (seeds), retain viability and enhance germination.

Approach: The overall strategy is to develop a cleaning/conditioning technology wherein, by aerobic and anaerobic fermentation procedures, the seed is freed from the sterile florets and the redox potential of the seed can be regulated in order to preserve its viability and enhance its germination. The fermentation slurry will be conditioned with oxidants, reductants, osmoticum, divalent cations and its hormone balance adjusted to preserve and enhance germination. The conditioned seed will be either pelleted or prepared for direct seeding by fluid drilling. Dormancy and germination studies will be conducted on thermogradient plates and final results evaluated by field trials.

Progress: 83/01 to 83/12. High rates and uniformity of germination are essential for the efficient production of guayule bio-mass. Seeds produced by the postharvest cleaning procedure, adopted from the Emergency Rubber Project, have performed poorly in direct seeding trials. Raw seeds imbibed in polyethylene glycol solution (25% w/v, mol. wt. 8000) containing gibberellic acid, potassium nitrate and other chemicals remain dormant for weeks in darkness at 25 C. On decreasing the osmotic stress to -1.0 bars or less, seeds germinate ca. 100% in 3-4 days. Furthermore, light (620 nm) treatments promote germination over a broader temperature optima. These studies suggest that by a proper physiological manipulation of the photo-, thermo-, and other dormancy factors, the planting quality of raw guayule seeds can be markedly enhanced in conditioned seeds.

Publications: 83/01 to 83/12

CHANDRA, G.R., BUCKS, D.A., TOOLE, V.K. 1983. Progress in Guayule (*Parthenium Argentatum*) seed conditioning technology. Guayule Rubber Society IV Annual Conference, June 20, 1983. (Abstract).

03.033 CRIS0080015
DEVELOPMENT OF NEW AND IMPROVED CROPS FOR WATER CONSERVATION IN ARID LANDS

ROBINSON G; HAMMOND R; HOWLAND J; Plant Soil & Water Science; University of Nevada, Reno, NEVADA 89557.

Proj. No.: NEV00808 Project Type: HATCH
Agency ID: CSRS Period: 01 OCT 79 to 30 SEP 85

Objectives: Develop domestic varieties of the buffalo gourd (*Curcubita foetidissima*) which will produce useful products under minimum water regimes and identify appropriate production, harvesting, and processing techniques for such new plants. Breed improved cultivars of guayule (*Parthenium argentatum*) having a high rubber content (15-20%), and develop economical cultural and harvesting procedures with emphasis on growing guayule under minimum water regimes.

Approach: Collections of native buffalo gourd will be made in Southern Nevada. We will receive collections from other participating states and establish nurseries at Southern Nevada Field Lab., Overton, Nevada and at Holly Park Field Lab., Pahrump, Nevada in which all entries are tested on field performance. Guayule cultivars received from the germ plasm distribution centers in Arizona will be field tested for cold tolerance at Southern Nevada Field Lab., Holly Park Field Lab., and at such other locations in Nevada deemed necessary.

Progress: 83/01 to 83/12. Buffalo gourd fruit yields ranged from 12-27 gourds per plant the first year of planting and 21-46 per plant in subsequent years. Differences in yields were greater for the ten selections grown than between years after the first year. Root yields of three year old plants ranged from 1000-1500 grams per plant for the ten selections. Buffalo gourd can be grown under limited irrigation in Southern Nevada. Eight varieties of Guayule

were planted under drip irrigation in a sandy soil in Southern Nevada. Plantings were made each year from 1980 through 1982. Seed was set on all varieties each year but no yield data was taken. Top growth yields were taken the second and third year after planting. Second year yields ranged from 500-600 grams per plant and third year 800-900 grams per plant for the eight varieties. Yields are comparable to other areas. Guayule can be grown under low water management in Southern Nevada with acceptable yields.

Publications: 83/01 to 83/12

NO PUBLICATIONS REPORTED THIS PERIOD.

03.034* CRIS0030039
ADAPTATION AND CULTURAL PRACTICES FOR NONTRADITIONAL CROPS WITH POTENTIAL FOR THE HIGH PLAINS OF MEXICO

FINKNER R E; Agri Science Center At Clovis; New Mexico State University, Las Cruces, NEW MEXICO 88003.

Proj. No.: NM-1-3-42143 Project Type: STATE
Agency ID: SAES Period: 01 JAN 85 to 30 JUN 89

Objectives: Determine high yielding, well adapted cultivars of several nontraditional crops, i.e., soybeans, sunflowers, onions for seed, crambe, rapeseed, Jerusalem artichokes, guayule, grapes, chick-peas, pearl millet, buffalo gourds, and other minor crops which may have potential value for the High Plains area of New Mexico. Study the effects of varying cultural practices on yield and quality of the species and cultivars under study. Investigate problems which develop, relating to the adaptation and production of nontraditional crops.

Approach: Replicated field tests and lab analyses will be used to determine the highest yielding and the best quality cultivars and the most productive cultural practices.

Progress: 84/01 to 84/12. Field tests were conducted on various crops for yield and quality. Thirty grain corn hybrids produced an average yield of 10,111 kg/ha. The average yield of ten forage corn hybrids was 8.02 T/ha of dry matter. Sixteen soybean cultivars had an average grain yield of 2940 kg/ha. Ten sunflower hybrids were yield tested under dryland and full irrigated conditions. Dryland yields averaged 2191 kg/ha with a 45.2 percent oil. The dryland test was furrow diked and a total of 41.35 cm of moisture fell with no runoff. Yield of the irrigated hybrids only averaged 1544 kg/ha with a 44.9 percent oil. The test was irrigated twice. This year, furrow diking was more effective than irrigating in producing high yields.

Publications: 84/01 to 84/12

FINKNER, R.E. April 1984. Soybean variety trials on the High Plains of eastern New Mexico, 1978 through 1983. NMSU Agri. Exp. Sta. Res. Rep. 536.

FINKNER, R.E. May 1984. Response of pinto bean varieties to date of planting on the eastern High Plains. NMSU Agri. Exp. Sta.

Res. Rep. 541.

03.035 CRIS0093573
GUAYULE SEED AND SHRUB PRODUCTION AND TESTING

WHITWORTH J W; Crop & Soil Sciences; New Mexico State University, Las Cruces, **NEW MEXICO** 88003.

Proj. No.: NM-1-5-28228

Project Type: NATIVE LATEX

Agency ID: CSRS Period: 15 MAY 84 to 31 MAY 86

Objectives: Produce seed of six existing guayule cultivars for use in direct seeding and other types of research and to have a seed supply for possible commercialization. Produce guayule shrub for processing research. Obtain data and information concerning the yield and quality of rubber from existing cultivars, potential cultivars and lines. Evaluate weed control alternatives using plantings from objectives 1, 2, and 3.

Approach: Seed will be harvested in 1984 from 30 acres established in 1981. Guayule plants on this acreage will be sampled for yield and quality of rubber as well as seed production and the entire acreage will be available for the production of shrub for research on large scale methods of rubber extractions and processing. Weed control evaluations will be conducted on existing stands and on any new plantings established to evaluate the yield and quality of rubber from existing cultivars vs potential cultivars and lines.

03.036 CRIS0080421
DEVELOPMENT OF NEW AND IMPROVED CROPS FOR WATER CONSERVATION IN ARID LANDS

WHITWORTH J W; FEUHRING H D; ROBERTS C L; Crop & Soil Sciences; New Mexico State University, Las Cruces, **NEW MEXICO** 88003.

Proj. No.: NM-1-5-27164 Project Type: HATCH
 Agency ID: CSRS Period: 01 OCT 79 to 30 SEP 85

Objectives: To evaluate species of Cruciferae which will produce useful products under minimum water regimes and to develop effective production practices, and to breed improved cultivars of guayule (*Parthenium argentatum*) having a high rubber content (15-20%), and to develop economical cultural and harvesting procedures with emphasis on growing guayule under minimum water regimes.

Approach: Crambe cultivars and accessions will be grown near Las Cruces to evaluate them for yield, oil content, response to variable seeding date, fertilizer rates, pest control methods, and irrigation management. Guayule accessions will be evaluated for cold tolerance, rubber yield with limited water and response to growth regulators; various methods of weed control will be evaluated also.

Progress: 84/01 to 84/12. New Mexico is continuing with its assignment of developing and testing guayule cultivars with good cold tolerance and high rubber production which can be grown in the state where rainfall is adequate but temperatures are questionable. A composite of seed from Mexico via California was screened at two locations on the far northern fringe of the guayule survival zone in New Mexico. At Artesia, a large number of plants established by direct field seeding in May of 1982 survived a severe temperature fluctuation in December of 1983 when the high daytime temperature of 24 C went to a low of -20 C at night. In a similar planting at Clovis, no plants survived, however, a small number survived in the direct seedings made in 1980 and 1981. Individual plant survivors were selected on the basis of vigor and biomass and are being analyzed for rubber content. If the selections are high in rubber and cold tolerant enough to grow at these two locations, rainfall is adequate so that no supplemental irrigation will be required after establishment by direct seeding. While on sabbatical leave in Australia, 1983-1984, the principal investigator helped establish a transplanted field of guayule without supplemental irrigation. Rainfall in this area averages 400 mm per year. The planting consisted of four plant densities and three cultivars. Periodic soil moisture readings and sampling for rubber yields were made and samplings will be continued over a three year period.

Publications: 84/01 to 84/12
 MILTHORPE, P.L. (WHITWORTH, J.W. a contributor). 1984. Guayule research and development in New South Wales, 1980-1983. Report, 1st edition, 2nd impression, Department of Agriculture New South Wales, Australia, 45 p.

03.037 CRIS0083504
INFLUENCE OF ESTABLISHMENT METHODS AND HERBICIDES ON GUAYULE RUBBER; EFFECTS OF NEMATODES

WHITWORTH J W; THOMAS S H; Crop & Soil Sciences; New Mexico State University, Las Cruces, **NEW MEXICO** 88003.

Proj. No.: NM-1-5-28219

Project Type: NATIVE LATEX

Agency ID: CSRS Period: 01 SEP 80 to 31 AUG 84

Objectives: Determine the most effective method of direct field seeding of guayule. Develop more effective herbicides combinations for weed control in guayule fields. Compare rubber production as influenced by herbicide regimes. Determine reduction in growth of guayule associated with plant parasitic nematodes. Monitor the response of nematode populations to guayule as a food source.

Approach: Direct seeding experiments will involve the use of trickle and furrow irrigation, seed coatings, hydrogels and preplant irrigations to produce maximum emergence of guayule and survival where salt and drying out are problems. Herbicide evaluations will be continued in the greenhouse

and the field. Evaluation of nematode effects will be accomplished by infesting guayule plants with four major types of plant parasitic nematodes.

Progress: 81/01 to 81/12. Plantings of guayule established by direct field seeding produced rubber yields equivalent to plantings established by transplants. Adequate stands of guayule were obtained by direct seeding methods which involved planting in the bottom of a 1 cm deep furrow on top of a listed bed and keeping the irrigation furrow full of water until germination occurred. Under this system, no covering over the seed produced the best stands. DCPA and pendimethalin were the only two herbicides safe to use on direct seeded guayule. A combination of oxyfluorfen and trifluralin or oryzalin were selective on transplant or established guayule and gave six month's control of all annual weeds. Reduction in rubber yields due to herbicides only occurred when other herbicides that were used reduced the stands of guayule. Surviving plants that had sustained mild damage due to herbicides recovered and showed no reduction in rubber yields. Of the four species of plant parasitic nematodes tested, only *Macroposthonia* increased in population over the initial level and the associated plants showed some decrease in top weight. In additional tests, root weight of cultivars 11591, 12229, 11605, and N-565 grown in 15 cm pots was reduced 36, 26, 25 and 12%, respectively. Reductions in the above ground biomass did not always parallel reduction in root biomass.

Publications: 81/01 to 81/12

- WHITWORTH, J.W. 1981. Herbicides for weed control in guayule. *El Guaylero* 3(1):13.
WHITWORTH, J.W. 1983. Seed quality, field seeding, and plant survival of guayule. *El Guaylero* 5(1):7.
WHITWORTH, J.W. 1984. Dryland guayule production in NSW, Australia. *El Guaylero* 6(1-2):25.
CLARK, D.R. 1981. The effect of herbicides on transplanted guayule (*Parthenium argentatum*). M. S. Thesis, New Mexico State University, 47 pp.

03.038 CRIS0043764
REDUCTION OF SALT DAMAGE TO SUGARCANE AND OTHER CROPS

THOMAS J R; REKTORIK R J; Agricultural Research Service, Weslaco, TEXAS 78596.
Proj. No.: 6204-20730-002-00D

Project Type: INHOUSE

Agency ID: ARS Period: 12 MAY 77 to 29 JUL 83

Objectives: Develop soil and water management practices that limit salt damage to sugarcane and other crops, soils, and water resources and develop efficient and effective methods for reclaiming salt-affected agricultural lands..

Approach: Test effect of water quality on soil salinization and on growth and sugar yields of sugarcane. Characterize the capacity of soils to supply N and determine interaction of fertility and salinity on sugarcane and

Bermudagrass yields. Relate design criteria of drainage systems for sugarcane and other crops to irrigation water quality, amount and frequency of irrigations, use of leaching water, depth to the water table, climatic conditions, and soil profile characteristics..

Progress: 82/01 to 82/12. Depths of the static water tables affected slightly the growth of guayule lines N396 and 11591. One hundred eighty three days after transplanting of seedlings, the mean growth index had increased 901 and 809 cm. 2, respectively, on the 150-c and 210-cm. depth water table. Irrigating nine month-old guayule seedlings with saline waters did not affect plant growth during a 10-month period. Irrigation water salinities ranged from 0.9 to 4.5 dSm - 1. A total of 146 cm. of water was applied.

Publications: 82/01 to 82/12

NO PUBLICATIONS REPORTED THIS PERIOD.

03.039 CRIS0043706
IMPROVE IRRIGATION AND DRAINAGE OF AGRICULTURAL LAND IN THE LOWER RIO GRANDE VALLEY, TEXAS.

NAMKEN L N; THOMAS J R; Conser & Prod Systems Res Unit; Agricultural Research Service, Weslaco, TEXAS 78596.
Proj. No.: 6204-20740-003-00D

Project Type: INHOUSE

Agency ID: ARS Period: 29 MAR 77 to 29 MAR 82

Objectives: Develop advanced water management practices, methods, equipment, and systems to efficiently utilize soil, water and energy resources and increase agricultural productivity.

Approach: Manage water tables to obtain optimum crop growth, maturation, and field trafficability during harvest. Compare relative performance characteristics of trench-in and plowed-in subsurface drains with and without spun-bonded nylon or gravel envelopes with representative soils and salinity conditions. Upgrade design criteria of manifold well point drainage systems. Adapt USDA irrigation scheduling method to local citrus and sugarcane growing practices. Ascertain irrigation requirements of short season cotton cultivars. Determine effect of cold protection treatments (heater blocks, flood irrigation, and nonprotected control) on yield and tree damage of citrus.

Progress: 82/01 to 82/12. Container type, size and season of year significantly affected survival of guayule seedling transplants under dryland conditions. Fall planted native seedlings had a larger survival percentage than spring planting. Eighteen months after transplanting on dryland, 45 to 57% of the guayule plants from USDA lines were growing satisfactorily. Most of the seedlings loss occurred within 30 days of transplanting. Biomass production after 18 months was 29.0 and 36.4 metric ton/ha., respectively, for nonirrigated and irrigated guayule. Optimum stem yield was associated with a leaf N concentration of 3.3%.

Publications: 82/01 to 82/12

GONZALEZ, C.L. and REKTORIK, R.J. 1982.

Establishment of Guayule transplants under dryland conditions in south Texas. Guayule Rubber Society. (Abstract).

03.040 CRIS0082460
**DEVELOPING SALINITY, IRRIGATION AND FERTILITY
 MANAGEMENT OF GUAYULE GROWN WITH GYPSEOUS
 SALINE WATER**

MIYAMOTO S; FENN L B; Texas A&M University,
 College Station, TEXAS 77843.
 Proj. No.: TEX-080-00607

Project Type: NATIVE LATEX

Agency ID: CSRS Period: 01 SEP 80 to 31 AUG 84

Objectives: Evaluate salt tolerance of guayule,
 including salt effects on rubber yields.

Evaluate water requirement and water stress
 effects on rubber yields under the influence of
 salinity. Develop and test appropriate
 irrigation schedules for growing guayule with
 gypseous saline waters. Evaluate nitrogen and
 phosphorus requirement for growing guayule.

Approach: For objective 1 and 2, lysimeter and
 field plot tests will be utilized. For
 objective 3, irrigation and salinity control
 models will be developed and solved with a
 microcomputer. Greenhouse and field tests
 supplemental with laboratory work will be used
 for objective 4.

Progress: 81/09 to 84/08. Because of the
 strategic and industrial importance of natural
 rubber, there has been renewed interest in
 cultivating guayule. This project was performed
 for developing salinity, irrigation and
 fertility management necessary for cultivating
 guayule in the Southwest under irrigation. The
 major accomplishments at termination include:
 review of water quality, quantity and land
 resources available for potential guayule
 production in West Texas; quantification of
 guayule salt tolerance (including eight
 cultivars) at and following transplanting
 establishment; discovery and understanding of
 high salt sensitivity of guayule hypocotyl and
 seedling, and its implication to direct seeding
 establishment; quantification of water
 requirements for guayule cultivation both in
 quantity and quality; seedling responses to
 nitrogen and calcium; and development of
 conceptual production schemes involving direct
 seeding establishment with drip or sprinkler
 irrigations and harvesting through clipping.
 The research activities of this project year
 concentrated on the aspects related to c, d,
 and e. To make guayule cultivation more
 economical, additional studies are needed,
 especially in the areas of direct seeding
 establishment and clipping harvest. Low water
 use efficiency and low rubber contents of
 guayule shrubs, and high salt sensitivity of
 seedlings are some of the difficulties for
 commercial cultivation.

Publications: 81/09 to 84/08

MIYAMOTO, S., MOORE, J. and STICHLER, C.

1984. Overview of saline water irrigation
in far West Texas. Proc. Irrig. & DrainageSpeciality Conf. ASCE, Flagstaff, AZ "Water
Today and Tomorrow".

MIYAMOTO, S., SOSNOVSKE, K. and TIPTON, J.

1982. Salt and water stress effects on
germination of guayule seeds. Agr. J.
74:303-307.

MIYAMOTO, S., PIELA, K., DAVIS, J. and FENN,

L.B. 1984. Salt effects on emergence and
seedling mortality of guayule. Agr. J.
76:295-300.

MIYAMOTO, S., PIELA, K. and GOBRAN, G. 1984.

Salt effects on transplant mortality,
growth and rubber yields of guayule. Irrig.
Sci. (In Press).

MIYAMOTO, S., PIELA, K. and DAVIS, J. 1984.

Water use, growth and rubber yields of four
guayule selections as related to irrigation
regimes. Irrig. Sci. 5:95-103.

03.041 CRIS0093253
**FIELD CROP PRODUCTION SYSTEMS FOR THE RIO
 GRANDE PLAINS**

MULKEY J R JR; Agr Res Cnt; Texas A&M
 University, Uvalde, TEXAS 78801.

Proj. No.: TEX06702 Project Type: HATCH
 Agency ID: CSRS Period: 13 JUL 84 to 07 DEC 89

Objectives: Determine through soil testing and
 fertilizer application rates the levels of
 fertilizer necessary to produce optimum yields
 and quality; conduct applied research in
 water-use efficiency relating to supplemental
 water requirements of major crops; study the
 effects of tillage operations both during the
 fallow and growing season on water conservation
 in dryland crops.

Approach: Major field crops will be studied
 under different levels of fertility,
 irrigation, planting dates, plant population,
 row spacing, tillage and alternative management
 practices that might influence performance and
 quality.f.

Progress: 84/01 to 84/12. Low yields or crop
 failures were experienced in dryland research
 plots due to the extreme drought conditions
 that prevailed throughout the growing season.
 Furrow diking studies on dryland sorghum and
 wheat showed no significant differences between
 plots that were diked during the growing
 season, fallow period or a combination of both.
 Rainfall events occurred in such low intensity
 that no runoff occurred making diking
 ineffective. Yields in irrigated sesame
 performance trial were excellent, averaging
 1981 kg/ha. UCR-3 and one nonshattering line
 produced yields in excess of 2240 kg/ha. Sesame
 yields in plant population studies were
 significantly increased when two rows were
 planted to the bed with increased plant
 numbers. In a 2 year study, sesame responded to
 early plantings. Plantings made in April
 bloomed 12 days later, matured 26 days later,
 produced larger leaf masses, higher thrashing
 percentages and 42% higher yields than
 plantings made in June. Plantings made in May
 were immediate. Responses were measured to
 nitrogen in both the irrigated sorghum and corn
 fertilizer plots. The two year old guayule
 performance test averaged 468 kg/ha of rubber

across all varieties.

Publications: 84/01 to 84/12

MULKEY, J.R., JR. and DAINELLO, F.J. 1984.
Nondestructive method to measure the leaf
areas of spinach and cucumbers. TAES
MP-1555.

MULKEY, J.R., JR., DRAWE, J. and ALBACH, E.L.
1984. Soybean variety in Southwest Texas.
TAES PR-4200.

03.042

CRIS0079925

**DEVELOPMENT OF NEW AND IMPROVED CROPS FOR WATER
CONSERVATION IN ARID LANDS**

MOORE J; Agricultural Exper. Station; Texas
A&M University, El Paso, TEXAS 79927.

Proj. No.: TEX03578

Project Type: HATCH

Agency ID: CSRS Period: 01 OCT 79 to 30 SEP 86

Objectives: Develop domestic varieties of the
buffalo gourd (*Curbubita foetidissima*) which
will produce useful products under minimum
water regimes and identify appropriate
production, harvesting, and processing
techniques for such new plants. Breed improved
cultivars of guayule (*Parthenium argentatum*)
having a high rubber content (15-20%), and
develop economical cultural and harvesting
procedures with emphasis on growing guayule
under minimum water regimes. Improve guar
(*Cyamopsis tetragonoloba*) production under
minimum water regimes through the development
of high-yielding varieties adapted to such
conditions and identify efficient production
practices for this species.

Approach: Wild populations will be surveyed and
selections made based on appropriate criteria.
Cultural practices will be investigated under
dryland and irrigated conditions.

Progress: 84/01 to 84/12. This research is
designed to establish the cultivation of
Parthenium argentatum (guayule) for the
production on natural rubber. Our objectives
include direct seeding for field establishment,
plant density and irrigation level effects on
rubber production, and germplasm evaluation.
Root regeneration of seedlings is affected by
age. The number and length of new roots were
significantly greater after 3, 6, 9, and 12
days for 12 week old as compared to 8 week old
plants. The major difference between 10 and 12
week old plants was an increased root length of
0.44 and 1.03 cm, respectively, after 3 days.
There was no difference in dry weight among 7
varieties after 1 year in the field, but
significant differences were apparent in rubber
concentration. Variety 11605 had the highest
concentration with 3.75 percent (of dry weight)
and CAL-1 the lowest with 0.74 percent.
Varieties 11591, 11619, 12229, N565, and N576
were intermediate with concentrations ranging
from 3.43 to 2.17 percent.

Publications: 84/01 to 84/12

TIPTON, J.L. 1984. Guayule seedling root
regeneration potential increases with age,
HortScience 19(5):713-714.

TIPTON, J.L. 1984. Advances in arid-land
agriculture. Proceed. of the second
Chihuahuan Desert Symposium (in press).

03.043

CRIS0082423

**ESTABLISHMENT AND CULTIVATION PRACTICES FOR
GUAYULE PRODUCTION IN WEST TEXAS**

TIPTON J L; MOORE J; STONE J D; Agricultural
Exper. Station; Texas A&M University, El Paso,
TEXAS 79927.

Proj. No.: TEX04339(6773)

Project Type: NATIVE LATEX

Agency ID: CSRS Period: 01 SEP 80 to 30 AUG 84

Objectives: Estimate effect of planting date,
irrigation methods, and seed treatment on
establishment by direct seeding. Estimate
effect of irrigation level and plant spacing on
rubber and seed production. Selection
high-yielding individuals from native Texas
populations and increasing seed. Collect and
identify insects and evaluate real and
potential damage.

Approach: Variables in direct seeding include
pregermination and fluid drilling, sprinkler
versus furrow irrigation, and May to September
planting. Those in rubber and seed production
include 2 densities and 5 levels of soil
moisture. Selection will be based on leaves and
inflorescences.

Progress: 81/05 to 82/05. Trials indicate
pregerminated seed can be separated from
nonpregerminated seed as early as 12 hours
after treatment utilizing a 1.14 specific
gravity solution. Higher sucrose concentrations
have a detrimental effect on germlings. An
pregermination during increases the specific
gravity required to achieve separation in both
emergence rate and final percent emergence
declines. U.S.D.A. lines N396 and 11634 were
superior in both rubber content and
extrapolated rubber yield 14 months after field
transplanting. The extrapolated yields were 126
pounds per acre for N396 and 124 pounds per
acre for 11634 (above ground components only).
Morphological characteristics associated with
high rubber contents in a bulk planting are:
Tall plants; large, green leaves; and thick
peduncles. These same characteristics occur in
some plants of U.S.D.A. line 11605. While no
single insect has been dominant as a pest in
guayule, the following appear to have
potential: Leafhoppers, lygus bugs, a seed
weevil, and several types of leaf feeders
(beetles, moths, grasshoppers, etc). Beneficial
insects are numerous, dominated by lady
beetles, nabids, and lacewings.

Publications: 81/05 to 82/05

MIYAMOTO, S. K. SOSNOVSKE and J. TIPTON.
1982. Salt and water effects on germination
of guayule seeds. *Agron. J.* 74:303-307.

03.044 CRIS0089816
**BIOLOGY AND MANAGEMENT OF SPECIFIC INSECT PESTS
 IN FAR WEST TEXAS**

STONE J D; BUENO R B; FRIES J N; Agricultural
 Research Center; Texas A&M University, El Paso,
 TEXAS 79927.

Proj. No.: TEX06595 Project Type: HATCH
 Agency ID: CSRS Period: 01 APR 83 to 31 MAR 88

Objectives: Examine composition, biology, and
 phenology of the urban pest complex with
 emphasis on white grub populations in turf.
 Determine the nature of blackmargined pecan
 aphid parasite populations and refine
 laboratory rearing techniques. Monitor
 recurring pest problems on alfalfa, pecans and
 chile to determine the need for field control
 trials.

Approach: Field populations of the urban pest
 complex will be assessed by soil sampling and
 black light traps, insect rearing technologies
 will be developed in the laboratory and
 greenhouse, and insecticide controls will be
 compared to non-chemical management factors
 such as varying turf type, moisture level, etc.
 Field sampling for pecan aphid parasites will
 allow continued assessment of species, and
 laboratory rearing techniques will be developed
 to assess the impact of environmental
 variables.

Progress: 84/01 to 84/12. Increased emphasis
 was placed on urban entomological problems in
 1984, completing the shift from production
 agriculture begun in 1983. Pecans were retained
 as a part of the program. Urban. Elm leaf
 beetles, cicadas, and ground pearls are common
 in this area, but the ecology and control of
 white grubs remain the primary focus.
 Phyllophaga crinita ws the damaging species in
 every serious problem encountered, and light
 traps indicated that ca. 90% of the total
 collected were this species. Most other beetles
 were Cyclocephala pasadenae, a species that
 appears to occur where cultural conditions are
 less favorable. Light trap studies indicate
 that the two species are ecologically separated
 by flying at different times of night and at
 different heights above the soil. Larval
 stratification studies continue to indicate
 that larvae commonly occur far deeper than
 previously thought, even during summer feeding
 months. In control trials conducted to compare
 materials believed efficacious, older materials
 continued to provide adequate control,
 confirming that delivery of the materials may
 be more of a problem than their efficacy.
 Trials to evaluate timing of insecticide
 application indicate that June/July applications
 give maximum control. Pecans. Aphids (black and
 blackmargined) are the only insect problems
 commonly occurring in area pecans. Parasitism
 rates of the blackmargined aphid parasite,
 Aphelinus perpallidus, were relatively low in
 1984. No hyperparasitism was detected.

Publications: 84/01 to 84/12

STONE, J.D. and WATTERSON, G.P. 1984. Effects
 of temperature on the development and
 survival of the Morrill lace bug on
 Guayule. Accepted by Environmental
 Entomology.

STONE, J.D. 1983. Phytotoxicity of insecticides
 to Guayule (Parthenium argentatum Gray).
 Tex. Agric. Expt. Stn. Prog. Rept. PR-4207.
 5 pp.

03.045 CRIS0072697
**CROP WATER USE AND IRRIGATION SCHEDULING UNDER
 SALINE CONDITIONS**

MIYAMOTO S; El Paso - Agr Res Cntr; Texas A&M
 University, El Paso, TEXAS 79927.

Proj. No.: TEX06030 Project Type: HATCH
 Agency ID: CSRS Period: 11 MAY 77 to 09 MAR 83

Objectives: Estimate crop water use under
 saline conditions. Evaluate effects of
 non-uniform salt distributions on water uptake,
 vegetative and root growth and yields. Estimate
 soil water and salinity distribution in
 irrigated soil profiles. Develop irrigation
 scheduling methods based on soil, water and
 meteorological data.

Approach: Field embedded lysimeter tests will
 be conducted to determine transpiration and
 evaporation relationships with potential
 evaporation, soil water, soil salinity and leaf
 area index. Compartment lysimeter tests will be
 performed to evaluate effects of non-uniform
 salt distributions, and a numerical analysis
 made for development of methods.

Progress: 82/01 to 82/12. With increasing
 demand for limited water resources, the
 efficient use of water is critically important.
 This project was developed to improve water use
 efficiency primarily through irrigation
 scheduling, and is being terminated as of
 12/82. Scope of the project included the
 evaluation of plant water requirement; salt
 tolerance; and development of scheduling models
 for pecan, chile, urban turfgrass, and a new
 crop, guayule. Pecans were found to be
 relatively tolerant while chile was sensitive
 to water stress. Guayule was relatively
 tolerant to water stress, but it should not be
 stressed when high yields per land area are
 desired. Water requirement for dried red chile
 is lower than that for green chile. Guayule
 water requirements increase sharply under
 saline conditions. Pecan water requirement
 increases with increasing tree size and
 planting density to a maximum of about twice
 that of cotton. Guayule was sensitive to salts
 during emergence and seedling growth. Chile was
 also sensitive to salts, especially during
 fruit growth. Pecan is moderately tolerant to
 salinity and suffers most from specific effects
 of Na and Cl ions. Common bermudagrass used for
 lawn purposes is exceptionally tolerant to
 salinity. We completed the irrigation
 scheduling model and program development for
 pecans. Similar scheduling programs were also
 developed for chile and for large lawn areas.

Publications: 82/01 to 82/12

MIYAMOTO, S., SOSNOVSKE, K. and TIPTON, J.
 1982. Salt and water stress effects on
 germination of guayule seeds. Agron. J. 74:
 303-307.

- MIYAMOTO, S. 1982. Scheduling pecan irrigation with microcomputers. Agron. Abs. p. 254 Anaheim, CA.
- MIYAMOTO, S., PIELA, K. and SULLIVAN, B. 1982. Guayule establishment under saline conditions. Nat. Guayule Conf., El Paso, Texas, Abst. 12.
- MIYAMOTO, S. 1982. Water requirement for growing pecans in Far West Texas and Southern New Mexico. Proc. Western Pecan Conf. 17: 18-25.
- MIYAMOTO, S. and GOBRAN, G. 1982. Assessment and potential remedies of salinity problems in pecan orchards of the middle Rio Grande Basin. Proc. Western Pecan Conf. 17: 26-31.

03.046 CRIS0014233
PHYSIOLOGICAL AND GENETIC CONTROL OF PLANT METABOLISM

BENEDICT C R; Plant Science; Texas A&M University, College Station, TEXAS 77843.
 Proj. No.: TEX01208 Project Type: HATCH
 Agency ID: CSRS Period: 01 OCT 82 to 30 SEP 87

Objectives: The objectives of this research are 3 fold to study the physiological and genetic mechanisms of the mode of action of bioregulators in increasing gene products in rubber synthesis. To study the mechanism whereby DNA levels control the levels of Rubisco and photosynthesis and to study the genetic control of non-photorespiratory and photorespiratory pathways.

Approach: The approach to these studies will involve: to study the regulation of rubber by inducing rubber formation in guayule plants with bioregulators, to study the levels of Rubisco and photosynthetic rates in Gossypium species known to have different ploidy (DNA levels), and to study the glycolate and glycolate pathways in guayule leaves and determine if the genetic control of PGA phosphatase and P-glycolate phosphatase regulates the carbon flow in these two pathways.

Progress: 84/01 to 84/12. The photosynthetic rates of several species of Gossypium are: G. klotzchianum, 31.6; G. herbaceum, 32.7; G. sturtianum, 48.3; G. stocksii, 58.0; and G. hirsutum, 53.1; mgCO₂/dm² h⁻¹, respectively. The rates are similar to those reported by Hesketh and co-workers. The photosynthetic rates are correlated (r=0.79) to pg DNA cell⁻¹. The relationship of root cell volume to nuclear DNA content established by Edwards and Endrizzi (1975) has been extended to leaf mesophyll cells. The cell volume of the mesophyll cells is correlated (0.81) to pg DNA cell⁻¹. The ratio of internal mesophyll cell surface area to external leaf area (Ames/A) available for CO₂ absorption is correlated (0.874) to pg DNA cell⁻¹. Nobel et al. (1975) has shown that the Ames/A is correlated to the photosynthetic rate of leaves. Cotton species with a low nuclear DNA content have small mesophyll cells, low Ames/A ratios and low photosynthetic rates. Species with a high DNA content, have larger mesophyll cells, high Ames/A ratios and high photosynthetic rates. We conclude that the DNA

content, mesophyll cell volume, and Ames/A ratios are important in determining the variation of photosynthesis in the species of Gossypium. Selecting plants with high levels of nuclear DNA may lead to an improvement of photosynthesis.

Publications: 84/01 to 84/12

- MAHAN, R.J., KOEHL, R.J. and BENEDICT, C.R. 1985. Variation of photosynthesis in species of cotton. Beltwide Cotton Production Research Conferences, New Orleans, LA.
- BENEDICT, C.R., MAHAN, R.J., YOKOYAMA, H., GAUSMAN, H.W. and KOEHL, R.J. 1985. Induction of terpenes in cotton by substituted tertiary amines. Cotton Physiology Conference Symposium. New Orleans, LA.
- GOSS, R.A., BENEDICT, C.R., KEITHLY, J.H., NESSLER, C.L. and STIPANOVIC, R.D. 1984. cis-Polyisoprene synthesis in guayule plants (Parthenium argentatum Gray) exposed to low, nonfreezing temperatures. Plant Physiol. 74:534-537.
- MADHAVAN, S. and BENEDICT, C.R. 1984. Isopentenyl pyrophosphate cis-1,4-polyisoprenyl transferase from guayule (Parthenium argentatum Gray). Plant Physiol. 75:908-913.
- BENEDICT, C.R. 1984. Physiology. IN: COTTON ed. R.J. Kohel and C.F. Lewis. A series of Monographs. American Society of Agronomy, Madison, Wisconsin. Chapt 6:151-200.

03.047 CRIS0089366
IMPROVING SALINITY AND IRRIGATION MANAGEMENT FOR EFFICIENT CROP PRODUCTION IN FAR WEST TEXAS

MIYAMOTO S; Research & Extension Center; Texas A&M University, El Paso, TEXAS 79927.
 Proj. No.: TEX06614 Project Type: HATCH
 Agency ID: CSRS Period: 04 FEB 83 to 03 FEB 88

Objectives: Evaluate salt tolerance of crops important to Far West Texas. Evaluate salt distribution and leaching requirement with emphasis on spatial variability. Evaluate chemical means of improving soil permeability. Develop salinity and water management models suitable for field use.

Approach: Lysimeter and field tests will be utilized with emphasis on pecan, chile, guayule and pistachio. Field tests (surface-irrigated pecan orchards) supplemented with some modeling work. Laboratory infiltration tests supplement with limited field tests. Modeling of evapotranspiration and salt movement and software development for microcomputer.

Progress: 84/01 to 84/12. With the dwindling reserve of fresh water, crop production in the western USA may have to rely more on saline waters for irrigation. This project is aimed at the development of management strategies that are required for growing high value crops with saline waters. The project contains three principal objectives: 1) evaluation of crop salt and water stress tolerance, 2) development of irrigation management models, and 3) evaluation of soil amendments for salt

leaching. During this reporting period, progress was made in all three areas. A manuscript documenting the results of salt tolerance study of three pecan rootstock cultivars was prepared and accepted for publication. Field experiments of pecan salt tolerance were extended by an additional season and the results will be documented shortly. The study of guayule response to salt and water stress appeared in publication 3 and 7. Two greenhouse experiments for studying salt effects on emergence and seedling mortality of several vegetable crops and guayule have been completed and the results are being documented for publication. In chemical amendment areas, the evaluation of gypsum dissolution rates and the effect of wetting agents on water infiltration were conducted as planned. Two review articles were also prepared; one on the overview of saline water irrigation in far West Texas (Publication 6) and another on water quantity and quality requirements of guayule.

Publications: 84/01 to 84/12

- MIYAMOTO, S., PIELA, K., DAVIS, J. and FENN, B. 1984. Salt effects on emergence and seedling mortality of guayule. *Agr. J.* 76:295-300.
- MIYAMOTO, S., PIELA, K. and DAVIS, J. 1984. Water use, growth and rubber yields of four guayule selections as related to irrigation regimes. *Irrig. Sci.* 5:95-103.
- MIYAMOTO, S. 1984. A model for scheduling pecan irrigation with computers. *Trans. ASAE* 27:456-463.
- SCHOLL, D. and MIYAMOTO, S. 1983. Response for alkali sacation and fourwing salt bush to various amendments on coal mine spoils from northwestern New Mexico: I. Acid spoil. *J. of Reclamation and Reveg. Res.* 2:227-236.
- MIYAMOTO, S., MOORE, J. and STICHLER, C. 1984. Overview of saline water irrigation in far West Texas. *Proc. Irrig. and Drainage Conf. ASCE. "Water Today and Tomorrow"*, p. 222-230.

03.048 CRIS0072107
FIELD CROP ADAPTATION AND PRODUCTION IN THE RIO GRAND PLAIN

MULKEY J R JR; Uvalde - Agr Res & Ext Cntr; Texas A&M University, Uvalde, TEXAS 78801.
 Proj. No.: TEX06251 Project Type: HATCH
 Agency ID: CSRS Period: 19 JAN 77 to 01 FEB 84

Objectives: Evaluate and determine the adaptation of crop varieties and new crops in the RioGrande Plain. Study the effects of planting dates on yield and quality, and of row spacing, plant population and geometry on yield and quality. Determine through soil testing and fertilizer application rates the levels of fertilizer applications necessary to produce optimum yields and quality. Conduct applied research in water-use efficiency relating to supplemental water requirements.

Approach: Varieties of the major field crops, along with new introduced crops, will be evaluated in replicated field plots. Superior varieties and promising new crops will be

evaluated under different levels of fertility, irrigation, planting dates, plant population, row spacing and other alternative management practices that might influence performance and quality.

Progress: 77/01 to 83/09. Soybens, sunflowers, guar, sesame and guayule were evaluated as new crops. All crops were well adapted except sunflowers. Satisfactory yields of sunflowers were not obtained regardless of cultivar or planting date. Poor nodulation was experienced from field grown guar. Good nodulation could only be produced in the greenhouse with high rates of inoculum. Soil fertility studies showed that on a fertile Uvalde clay loam that 20,000 kg/ha of corn must be removed before a response to N could be measured. Sufficient residual N was present to produce three consecutive crops. Additional years were required in sorghum for a response to occur due to the lower level of grain removal. Phosphorus placement both vertical and lateral were shown to influence the yield and maturity of onions more than the rate of application. Seedling growth and P uptake by onions were enhanced when P was applied in a band directly below the seed at a depth of 2.5 cm. Maximum yield was obtained when P was applied directly below the seed row at a depth of 2.5 to 7.5 cm. Sorghum plant population studies showed that grain yields were increased with higher populations but not with decreased row width. Corn showed large yield reductions in some years with narrow rows. Yields were reduced 23 and 13 percent respectively in 1976 and 78 when row width was decreased from 97 to 66 cm.

Publications: 77/01 to 83/09

- MULKEY, J.R., JR., VARNER, L.W., ALBACH, E.L. and DRAWE, H.J. 1982. Leaf removal to simulate grazing of corn by lambs. *Agron. J.* 74:764-765.

03.049 CRIS0093338
INTERACTIONS BETWEEN RESEARCH AREAS WITHIN TEXAS AND WITHIN THE GUAYULE GROWING REGION

MOORE J; ENGLER C; TIPTON J; Agricultural Research Station; Texas A&M University, Pecos, TEXAS 79772.
 Proj. No.: TEX-02-2367(6775)
Project Type: NATIVE LATEX
 Agency ID: CSRS Period: 15 MAY 84 to 31 MAY 86

Objectives: Conduct Regional Field Trials: This is a cooperative effort with Texas, New Mexico, Arizona, and California to evaluate the performance potential of currently available and promising new lines under replicated tests. Work in Texas will be at Ft. Stockton and Uvalde by TAES. Develop Breeder and Foundation Seed: Seed from identified lines and varieties of plants will be collected and saved for research studies. Seed from plants of high rubber content will also be increased to allow further evaluation of these collections.

Approach: Identify Germplasm, Plant Selection, and Agronomic Methods: Plants having superior rubber content and growth characteristics will

be selected for increase and evaluation. Agronomic management techniques for growing guayule will be evaluated. Develop Processing and Feedstock Methods: A pilot processing plant will be operated to develop information on solvent selection, costs of operation, and expansion to larger pilot plant operations.

03.050 CRIS0096107
 INTEGRATED RESEARCH PROGRAM FOR GUAYULE IN
 TEXAS

MOORE J; WAGNER J; FOSTER M; Texas A&M
 Research Foundation; Texas A&M University,
 Pecos, TEXAS 79772.
 Proj. No.: TEX-2-2558

Project Type: SPECIAL GRANT
 Agency ID: CSRS Period: 01 MAY 85 to 30 APR 86

Objectives: Conduct regional field trials on plant growth response and rubber formation. Results from Ft. Stockton and Uvalde in Texas will be combined with those from other states to provide information on currently available lines to indicate potential performance for each production region. Identify germplasm, plant selection, and agronomic methods. Characterizing rubber content of 24 identified lines and varieties along with individual plant selections will be done. Rubber content of morphologically grouped plants will be determined to evaluate correlation between rubber content and morphology.

Approach: Individual plants having high rubber content and superior growth characteristics will be increased for evaluation as potential lines. Agronomic studies will include direct seeding, pollarding, and pest management. Develop processing and feedstock methods. Operation of a pilot processing plant for guayule will develop information on operational costs, solvent selection, and expansion to larger pilot plants.

04.001 CRIS0045252
**PHYSIOLOGICAL STUDIES ON POLLINATION,
 FERTILIZATION & SEED OF NEW & ESTABLISHED
 AGRICULTURAL CROPS**

LOPER G M; Aridland Ecosystems Improvemt
 Research Unit; Agricultural Research Service,
 Tucson, ARIZONA 85721.
 Proj. No.: 5420-20180-012-00D

Project Type: INHOUSE
 Agency ID: ARS Period: 02 MAY 79 to 30 SEP 85

Objectives: Determine chemical structure and physiological role of plant compounds found to influence honey bee foraging activity, stigmatic receptiveness and fertilization of agricultural crops especially crops with hybrid seed production problems.

Approach: Determine chemical nature of flower, nectar, and pollen constituents that affect pollinators and pollination. Utilize these and other chemicals (viz., plant growth regulators) to improve attractiveness to bees and response of plants to pollinator activity. Study environmental and genetic influences on pollen viability, stigmatic receptivity, pollen tube growth and fertilization on established and new potential agricultural crops. Results of this research will be available for incorporation into production efficiency models.

Progress: 83/01 to 83/12. In field studies, it was documented that honey bees moved only 1/5 to 1/6 as much pollen from Pima sources as was moved from Upland cotton pollen sources. Floral color (yellow) and nectar sugar concentrations were different and provided distinctive cues permitting honey bee visitation discrimination. We have determined that a systemic gametocide applied to cotton to create male-sterile plants accumulates in the floral nectar at 15 to 97 ppm. Pollen traps on colonies around almond orchards stimulated pollen foraging, pollen collection and resulted in higher nut yields relative to an orchard without pollen traps. Very efficient traps (60-64%) also reduced brood rearing but, less efficient traps (16%) did not reduce broodrearing while stimulating foraging. Stigmatic receptivity was quantitatively examined in cotton (Upland, Pima, hexaploid, G. thurberi) by monitoring peroxidase levels. Peroxidase levels were lowest from 0600-0800 (2.2-6.1 ul O(2)/min.) but by 1300-1500 hrs. had reached their maximum levels (18-52 ul/min). Jojoba pollen, an excellent protein source (31-34%) was found to be a valuable food source for early spring colony buildup.

Publications: 83/01 to 83/12

HANNY, B., LOPER, G.M., & HARVEY, J. 1983. Chemical detection of PennCap-M (Registered Trademark) capsules in pollen, and methyl parathion residues in honey bees (*Apis mellifera* L.) and bee products from colonies near Arizona.

LOPER, G.M., WALLER, G.D., and DAVIS, D.D. 1983. Transfer of pollen by bees in hybrid cotton seed yields in Arizona. Proc. 1983 Beltwide Cotton Prod. Res. Conf. p. 94. (Abstract).

EISIKOWITCH, D. and LOPER, G.M. 1983. Some aspects of flower biology and bee activity on hybrid cotton in Arizona, U.S.A. J. Apic. Res. Accept. for Pub. (12/83).
 WALLER, G.D., LOPER, G.M., and MARTIN, J.H. 1983. The use of honey bees in production of hybrid cotton seed. Proc. Vth Int. Symp. Pollination, Versailles, France. In press.
 BUCHMANN, S.L. 1983. Buzz Pollination in Angiosperms. In: Handbook of Experimental Pollination Biology. C.E. Jones and R.J. Little (eds.). Van Nostrand-Rheinhold Inc., NY. p. 73-113.

04.002 CRIS0087545
**DOMESTICATION OF JOJOBA, SIMMONDSIA CHINENSIS
 (LINK) SCHNEIDER**

ROTH R L; GARDNER B R; Agri Engineering;
 University of Arizona, Tucson, ARIZONA 85721.
 Proj. No.: ARZT-174269-H-22-302

Project Type: HATCH
 Agency ID: CSRS Period: 01 JUL 82 to 30 JUN 87

Objectives: To determine the response of jojoba to water and nitrogen levels in terms of seed yields and plant growth.

Approach: A self-moving lateral sprinkler was modified to apply various levels of water and nitrogen. A central composite rotatable statistical design will be used to evaluate the data collected. The amount of water applied varies from 50 to 100% and the amount of nitrogen applied varies from 33 to 167%. This statistical design can predict a crop response function for 2 variables water and nitrogen. Data will be collected on plant nutrient levels and the soil water status.

Progress: 84/01 to 84/12. New cuttings from four different female jojoba cultivars were made last spring. These transplants are being grown in a greenhouse and will be available for transplanting in March, 1985.

Publications: 84/01 to 84/12
 NO PUBLICATIONS REPORTED THIS PERIOD.

04.003 CRIS0087552
**DOMESTICATION OF JOJOBA, SIMMONDSIA CHINENSIS
 (LINK) SCHNEIDER**

WERNER F G; Entomology; University of Arizona,
 Tucson, ARIZONA 85721.
 Proj. No.: ARZT-174021-H-31-304

Project Type: HATCH
 Agency ID: CSRS Period: 01 JUL 82 to 30 JUN 87

Objectives: Develop a manual for the recognition of insects and other arthropods likely to feed on native and cultivated jojoba in Arizona, and of symptoms of damage.

Approach: Set up regular surveillance of existing plantings of jojoba, in cooperation with the other workers in the interdisciplinary project. Expand the Pinto and Frommer survey of insects on native stands to get representative coverage of all Arizona areas, and during all

seasons. Develop a preliminary recognition manual based on Pinto and Frommer's report, and modify it as additional information is acquired.

Progress: 84/01 to 84/12. Jojoba continues to be an essentially pest-free plant in Arizona. There were no reports of any infestations in 1984, in either wild or cultivated plants. The basis for this unusually complete freedom from infestation would be a promising field of investigation. Even such generally ubiquitous insects as thrips are rarely on the plant.

Publications: 84/01 to 84/12
NO PUBLICATIONS REPORTED THIS PERIOD.

04.004 CRIS0090217
ECONOMICS OF JOJOBA MARKETING

FOSTER K E; ANGUS R C; Office of Arid Lands Studies; University of Arizona, Tucson. **ARIZONA** 85721.

Proj. No.: ARZT-174394-H-60-32

Project Type: HATCH

Agency ID: CSRS Period: 01 JUL 83 to 01 JUL 83

Objectives: Determine market penetration of jojoba oil as a result of substitutability for existing materials; investigate market entry price of jojoba oil; and identify future market potential for oil at various price levels.

Approach: The study is divided into three interrelated portions. Phase I - Economic Market Profile will determine the pricing available for jojoba oil and factors that govern market. Phase II - Market Penetration will investigate competition and opportunities for jojoba oil, and Phase III - Future Market Potential will investigate future markets, constraints, costs, availability and institutions for oil marketing.

04.005* CRIS0088201
ALTERNATIVES TO DESERTIFICATION IN ARID LANDS AGRICULTURE

FOSTER K E; WRIGHT N G; Office of Arid Lands Studies; University of Arizona, Tucson, **ARIZONA** 85721.

Proj. No.: ARZT-857254-G-60

Project Type: SPECIAL GRANT

Agency ID: CSRS Period: 15 AUG 82 to 31 AUG 85

Objectives: To examine the range of economic and agronomic conditions that might stimulate the development of jojoba, guayule, buffalo gourd, Russian thistle.

Approach: Refinement of economic production costs for the four crops in four areas, southern California, central Arizona, southwest New Mexico, and West Texas. Discussion of impacts of land, water, commodity tradeoffs and environment; and integration of Phase 1 and 2 into a commercialization outlook.

Progress: 81/01 to 81/12. Final cost budgets for guayule seed production were developed using the Digital Rainbow computer. These budgets use Super Calc software and is the first computer program that is available for guayule seed production analysis. Jojoba, buffalo gourd and Russian thistle budgets will be upgraded in 1985 using the same software. Final analysis of these low water use native plants and the infrastructure of these crops in arid lands agriculture is completed and ready for write-up.

Publications: 81/01 to 81/12
WRIGHT, N.G., LACEWELL, R.D. and TAYLOR, J.G. Cash Flow Summary for Producing One Acre of Guayule on Commercial Farms in the Southwestern U.S. Paper presented at the Guayule Rubber Society Fifth Annual Conference Washington.
WRIGHT, N.G. Contributed guayule rubber production budgets for Technical Bulletin 252. Agricultural Experiment Station, University of 252.

04.006* CRIS0081511
DISEASES OF "NEW CROPS" WITH EMPHASIS ON GUAR AND GUAYULE

ALCORN S M; Plant Pathology; University of Arizona, Tucson, **ARIZONA** 85721.
Proj. No.: ARZT-173666-H-05-24

Project Type: HATCH

Agency ID: CSRS Period: 01 OCT 83 to 30 SEP 86

Objectives: To determine the environmental-cultural factors which favor the epidemiologies of important pathogens and the expression of symptoms by hosts; to develop control procedures.

Approach: Twenty four a will be accomplished by determining causes of diseases of various aged guayules growing in various areas under varying irrigation regimes and from greenhouse-growth chamber studies.

Progress: 84/01 to 84/12. *Tilletia cuneatum* has been identified as causing a flower smut in experimental plantings of *Grindelia camporum*. The smut appears to have been introduced via seeds collected from *Grindelia* plants growing in the wild in California. Dying plants of *Cucurbita digitata* (in experimental plantings) had rotting roots from which pectolytic bacteria and *Rhizoctonia* spp. have been isolated. Koch's postulate studies are in progress. Experimental field plantings of *Cuphea Wrightii* and *C. toluca* were evidencing damping-off symptoms. Associated with stem and/or root lesions were *Fusarium* spp., *Rhizoctonia* spp., a *Pythium* spp., and several other fungi probably in the *Phythiaceae*. *Euphorbia lathyris* direct seeded in the field in October can be infected by *Macrophomina phaseolina* by January but remain symptomless until the following summer. In 1983 1.27% of 550 saguaros in 60 acres of plots died from bacterial necrosis; 2.73% were lost from all causes. Since approximately 1941, approximately 67.6% of all saguaros (including new plants occurring since 1941) in these plots no longer

survive. Of those lost, 85.3% (977 plants; 57.6% of all plants) had symptoms of bacterial necrosis. For information on guayule see 80-CRSE-2-0637 and 84-CRSR-2-2366 and on jojoba see SRZT-174112-H-05-303.

Publications: 84/01 to 84/12

MIHAIL, J.D. and ALCORN, S.M. 1984. Effects of soil solarization on *Macrophomina phaseolina* and *Sclerotium rolfsii*. Pl. Dis. 68:156-159.

YOUNG, D.J. and ALCORN, S.M. 1984. Latent infection of *Euphorbia lathyris* and weeds by *Macrophomina phaseolina* and propagule populations in Arizona field soil. Pl. Dis. 68:587-589.

MIHAIL, J.D. and ALCORN, S.M. 1984. Powdery mildew (*Leveillula taurica*) on native and cultivated plants in Arizona. Pl. Dis. 68:625-626.

COTTY, P.J. and ALCORN, S.M. 1984. *Alternaria raphani* on turnip in Arizona. Pl. Dis. 68:732.

ROTKIS, P.T. and ALCORN, S.M. 1984. Susceptibility of native plants to three soil-borne fungi endemic to the southwestern United States.

04.007 CRIS0087548
DOMESTICATION OF JOJOBA, SIMMONDSIA CHINENSIS (LINK) SCHNEIDER

ALCORN S M; Plant Pathology; University of Arizona, Tucson, ARIZONA 85721.
Proj. No.: ARZT-174112-H-05-303

Project Type: HATCH
Agency ID: CSRS Period: 01 JUL 82 to 30 JUN 87

Objectives: To identify suspected causal agents; to verify their pathogenicity; to assess the probable importance of the diseases they cause; to develop control procedures.

Approach: 24-a-will be accomplished by field surveys and the use of standard isolation techniques; b-by standard inoculation techniques; c-by field surveys plus historic knowledge of the effects of the organism(s); d-by selection of planting sites, altering horticultural techniques, the use of chemicals, and/or selecting tolerant plants.

Progress: 84/01 to 84/12. A computer program has been developed that allows the logging of the conditions of approximately 10,000 individual jojobas (transplanted into the field in California in 1979) that are being periodically surveyed for *Verticillium* wilt and other diseases. Subsequently, data can be summarized by year, by symptom-type, by organisms associated with symptoms, and by field site. There was no evidence of new *Verticillium* infections in 1984. However, more plants with orange-yellow symptoms were noted. These plants were more easily rocked by hand or wind compared with healthy plants. "Orange-yellow" plants sampled (by removal by a backhoe) had contorted, nearly horizontal roots, apparently as a result of being pot-bound at the time of transplanting. Most of these roots were shallow. Also, most sampled plants had root decay near the crown of the plant.

Fusarium spp. were consistently associated with the decay. No diseases were noted in 20-acres of cuttings transplanted about 5 months earlier in 1984 into a former cotton field. *Stemphyllium* was again associated with spots on leaves collected in a commercial planting in California.

Publications: 84/01 to 84/12

MIHAIL, J.D. and ALCORN, S.M. 1984. Effects of soil solarization on *Macrophomina phaseolina* and *Sclerotium rolfsii*. Pl. Dis. 68:156-159.

04.008 CRIS0063958
ADAPTATION AND CULTURE OF PLANT MATERIALS NATIVE TO ARID REGIONS

HOGAN L; JONES W D; LEE C W; Plant Science; University of Arizona, Tucson, ARIZONA 85721.
Proj. No.: ARZT-171200-H-25-54

Project Type: HATCH
Agency ID: CSRS Period: 01 JUL 73 to 30 SEP 82

Objectives: Investigate the control of vegetative growth and flowering, optimum nutritional levels of N, P, K, and Fe and to determine moisture requirements of arid landscape plants.

Approach: Experiments designed to establish boundaries for drought tolerance, nutritional requirements and control of vegetative control of growth and flowering of arid landscape plants using appropriate response measurements, controls, statistical designs.

Progress: 73/07 to 82/12. A collection of arid landscape plants was assembled from arid parts of the U.S., Mexico, Africa and Australia. Methods of propagating them by seed and vegetative means were studied for those difficult to propagate. Two cultivars of *Vauquelinia californica*, "Tonto" and "Molino" and one cultivar of *Suaeda vera*, 'Beersheeva' were released through the Arizona Experiment Station. Selections of other plants including *Rhus*, *Simmondsia*, *Acacia*, *Prosopis*, *Agave*, *Salvia* and *Dalea* species have been established and data as to temperature tolerance, growth and flowering has been recorded. Sixteen species of landscape plants were grown under high, medium, and low water regimes with the medium receiving 2/3 the amount of water and the low receiving 1/3 the amount of the high treatment. Two methods of delivery were used, trickle and spray. Tissue culture techniques were determined for both *Carica papaya* and *Scindapsus aureus*. Three graduate students were associated with this project.

Publications: 73/07 to 82/12

NO PUBLICATIONS REPORTED THIS PERIOD.

Q4.009* CRIS0084379
 PLANT REGENERATION AND SYNTHESIS OF USEFUL
 SECONDARY PRODUCTS FROM CELL SUSPENSION
 CULTURES

KATTERMAN F R; Plant Science; University of
 Arizona, Tucson, ARIZONA 85721.
 Proj. No.: ARZT-173871-H-25-12

Project Type: HATCH
 Agency ID: CSRS Period: 01 OCT 84 to 30 SEP 87

Objectives: To examine the processes of callus differentiation with regard to DNA synthesis antagonists and cytokinins. Selection of resistant or conditional mutants. Selection of callus lines and determination of the most favorable conditions for the maximum biosynthesis of economically valuable secondary products. Establishment of culture conditions for the culturing of viable protoplasts to the macro-callus stage.

Approach: Once we have made a comparative study of our systems to that of the differentiating and non-differentiating models with regard to relative levels of BUdR, thymidine, and cytokinin, we will examine the effects of these relative and competing levels on several specific enzymes. In addition, further studies on the regulation of HMG-CoA reductase will be undertaken. Comparisons of enzyme activity will be made between normal *E. lathyris* callus tissue and that of the mevanolin-resistant mutant with regard to varying levels, both separate and interactive, of the basic classes of phytohormones have been added. These results will then be compared to normal tissues to which varying levels of the inhibitor, as well as levels of the phytohormones, have been added.

Progress: 84/01 to 84/12. In order to isolate and culture protoplasts effectively as a prerequisite to any cloning of useful secondary product genes, it was necessary to delineate some of the factors involved in spontaneous protoplast lysis during isolation. The isolation of cotton anther callus protoplasts is greatly enhanced when the amino acids arginine, serine, or glycine, or the divalent cations Ca or Mg are included in the enzyme mixture. These compounds stabilize cotton protoplasts in the presence of RNase found in the cellulase enzyme mixture. The inhibition of RNase-induced lysis may involve cation or amino acid protection of critical membrane proteins during protoplast isolation. Using these protective agents, cotton protoplasts will give rise to macroscopic callus colonies after 3 weeks in culture.

Publications: 84/01 to 84/12

THOMAS, J.C. and KATTERMAN, F.R.H. 1984. The control of spontaneous lysis of protoplasts from *Gossypium hirsutum* anther callus. Plant Science Letters. 36:149-154.

04.010 CRIS0076437
 IMPROVEMENT & PROPAGATION OF PLANT MATERIALS
 SUITED FOR ARID REGIONS

LEE C W; JONES W D; Plant Science; University of Arizona, Tucson, ARIZONA 85721.
 Proj. No.: ARZT-173246-H-25-65

Project Type: HATCH
 Agency ID: CSRS Period: 01 OCT 82 to 30 SEP 86

Objectives: To develop improved landscape plant materials for use in arid regions. To develop propagation procedures for selected plant materials suited for arid regions.

Approach: Development of drought tolerant ornamentals. A xerophyte ornamental breeding nursery will be established to screen drought and heat tolerance. Desirable plant materials will be developed by selection and breeding. Development of propagation procedures. Asexual propagation (cutting and tissue culture) methods for selected desert ornamentals will be developed. Seed propagation procedures for selected herbaceous xerophytes will be developed.

Progress: 84/01 to 84/12. A drought tolerant, prostrate plant selected from the interspecific hybrid *Baccharis sarothroides* x *B. pilularis* was named as 'Centennial' *Baccharis* and released to the public. The interspecific cross between *Calliandra eriophylla* and *C. Californica* produced plants with showy, red flowers resembling those of the pollen parent. Cold and drought tolerance of this hybrid have yet to be determined. Another interspecific cross was successfully made between *Erythrina flabelliformis* (native to Arizona) and *E. bidwillii* in an effort to combine cold and drought tolerance with showy flowers. Seedlings of this cross are grown in containers. Procedures for propagating jojoba by single node cuttings were perfected. Tissue culture propagation procedures were also perfected for buffalo gourd and *Asclepias erosa*. Artificial media suitable for the germination of jojoba pollen were optimized to test the viability of pollen stored under low temperature conditions. As a part of efforts to domesticate *Penstemon parryi* as a new floral crop, seed germination procedures for greenhouse establishment of this plant were optimized by using gibberellic acid and low temperature (15 C). Seed germination in *Baileya multiradiata*, another potential ornamental for domestication was found to be stimulated by the presence of light. High mortality rates in grain amaranth plants grown from April and May were found to be the result of root infestation by *Conotrachelus seniculus* larvae.

Publications: 84/01 to 84/12

LEE, C.W. and PALZKILL, D.A. 1984. Propagation of jojoba by single node cuttings. HortScience 19:841-842.
 SIMONS, R.A. and LEE, C.W. 1984. A mathematical model for mutant cell selection for salt tolerance. J. Ariz. Nev. Sci. 19(s):39 (Abstract).
 LEE, C.W., THOMPSON, A.E., JONES, W.D. and HOGAN, L. 1984. 'Centennial' *Baccharis* interspecific hybrid. HortScience 19::903.

LEE, C.W. and THOMAS, J.C. 1984. Tissue culture propagation of buffalo gourd. HortScience (in press).
 LEE, C.W. and THOMAS, J.C. 1984. Propagation of *Asclepias erosa* by shoot tip cultures. HortScience (in press).

04.011 CRIS0087496
DOMESTICATION OF JOJOBA, SIMMONDSIA CHINENSIS (LINK) SCHNEIDER

PALZKILL D A; Plant Science; University of Arizona, Tucson, ARIZONA 85721.
 Proj. No.: ARZT-174134-H-25-301
 Project Type: HATCH
 Agency ID: CSRS Period: 01 JUL 82 to 30 JUN 87

Objectives: To select, develop and propagate superior clones of jojoba in terms of seed-yielding ability, cold tolerance and quantity of wax and meal.

Approach: Detailed data will be maintained on single plant performance in experimental plantings at 3 sites. Data will be recorded on seed yield, seed size, seed wax content, earliness, form, vigor, fruiting and flowering patterns, and seed abscission. Selections with superior qualities will continue to be increased vegetatively and studied further in yield and other tests before released to commercial growers. Surveys of natural populations will continue for obtaining additional single plant selection for inclusion in germplasm nurseries.

Progress: 84/01 to 84/12. Yield records were taken from selected plants at three U of A research stations; Mesa, Yuma Valley, and Yuma-Mesa. The Yuma-Mesa planting and 3/4 of the Yuma Valley planting were terminated after selections were made for further study. Consumptive water use of the eight year old planting at Mesa was monitored for the second year by John Nelson. A planting of six selected clones was established at the Maricopa Agricultural Center to be used for irrigation studies. Rooted cuttings of four selected clones were produced for an irrigation/fertility study which will be started in the spring of 1985 at Yuma. A study on response of selected jojoba clones to six phosphorus levels was begun. A study on physiological differences between jojoba clones which differ in frost tolerance was begun. Propagation studies were continued.

Publications: 84/01 to 84/12

FELDMAN, W.A., PALZKILL, D.A. and HOGAN, L. 1984. Leaf element concentrations of jojoba cuttings during vegetative propagation as related to nutrition and growth. Commun. in Soil Sci. Plant Anal. 15(4):353-373.
 LEE, C.W. and PALZKILL, D.A. 1984. Propagation of jojoba by single node cuttings. HortScience 19(6):841-842.

04.012 CRIS0066218
THE MORPHOGENESIS OF CALLUS AND ORGANOGENESIS OF JOJOBA (SIMMONDSIA CHINENSIS) TISSUE CULTURE

ROST T L; Agri Botany; University of California, Davis, CALIFORNIA 95616.
 Proj. No.: CA-D*-ABO-2957-H Project Type: HATCH
 Agency ID: CSRS Period: 29 AUG 74 to 31 DEC 82

Objectives: Characterize the growth condition requirements needed to generate jojoba callus and organ formation from various explant sources. Structurally analyze jojoba callus to determine its cellular makeup and tissue composition at both the light and electron microscope levels. Histochemical studies will be conducted to determine the distribution of proteins, nucleic acids and lipids relative to organ initiation.

Approach: Callus will be chemically fixed, embedded in paraffin or plastic, sectioned, stained, and examined at the light or electron microscope levels. Histochemical stains will be applied using published procedures primarily for light microscope level viewing. Cultures will be manipulated under aseptic conditions in a controlled environment to attempt to induce organogenesis.

Progress: 74/08 to 82/12. Jojoba shoot tip explants were excised and transferred to M&S culture medium supplemented with 3 percent sucrose, NAA and IPA at 10⁻⁵M and were maintained under a 12 h. photoperiod at 24-25 degrees C. This treatment induced elongation of the shoot explant, some branching and callus. To induce root initiation, elongated shoots were transferred to 1/2 X medium lacking IPA at 19 degrees C. Elongation of initiated roots occurred only after transfer to medium lacking hormones completely. We were not able to harden off fully developed plantlets for outside planting. Different plant parts were grown on culture medium and monitored for lipid contrast. Preliminary observations indicated that cotyledon callus was able to synthesize wax under culture conditions. These experiments were not followed up due to lack of continuous funding.

Publications: 74/08 to 82/12
 NO PUBLICATIONS REPORTED THIS PERIOD.

04.013* CRIS0091355
SALINE GROUNDWATER IRRIGATION TO REVERSE DESERTIFICATION

ROBINSON F E; Land, Air & Water Resources; University of California, Davis, CALIFORNIA 95616.
 Proj. No.: CA-D*-LAW-4386-SG
 Project Type: SPECIAL GRANT
 Agency ID: CSRS Period: 15 SEP 83 to 30 SEP 86

Objectives: Determine an efficient irrigation and cultural management of jojoba, guayule, olive, sugar beet, tamarisk, and barley utilizing saline ground water to reverse desertification. Monitor the moisture stress cycle of *Larrea tridentata* and *Palafoxia linearis*.

Approach: Utilizing sprinkler, spray, and biwall tubing with 1,430 mg/L TDS water for irrigation and using organic and chemical fertilizers with subsurface soil tillage to establish crops, monitor the plants with a soil neutron probe, an infrared thermometer correlation to Class A USWB pan to develop an efficient cultural technique for an arid desert.

Progress: 84/01 to 84/12. A moisture stress index for sugar beets was developed utilizing an infrared gun, a hand held anaemometer, and a sling psychrometer. In sandy desert plots on the Imperial East Mesa, the index was used to record significant stress difference between plants which had been grown in single vs double rows in biwall irrigated lines and between plots which had received subsoil disturbance and those which remained undisturbed. Neutron moisture probe access tubes were installed on olive, guayule, and sugar beet plants to observe moisture changes in the root zone. Indices of moisture stress for several plant species are under development. Biwall, spray, and sprinkler irrigation have been shown to be effective irrigation methods with water having 750 mg/L chlorides and 1430 mg/L total dissolved solids when used on sands. Where low quality water is available in areas of desertification, salt tolerant crops can be supported with these methods.

Publications: 84/01 to 84/12

- ROBINSON, F.E. 1984. Agricultural development of an arid sandy desert with saline irrigation in a geothermal well area. Proceedings of the International Symposium on Recent Investigations in the Zone of Aeration. Ed. P. Udluft, B.
- ROBINSON, F.E. 1984. Infrared analysis of sugar beet moisture stress due to root restriction and population. Agronomy Abstracts. 76th Annual Meeting, Las Vegas. Amer. Soc. Agronomy. p. 17. November.

04.014* CRIS0080420
DEVELOPMENT OF NEW AND IMPROVED CROPS FOR WATER CONSERVATION AND ARID LANDS

COGGINS C W; MURASHIGE T; ROOSE M L; Botany & Plant Sciences; University of California, Riverside, CALIFORNIA 92521.
 Proj. No.: CA-R*-BPS-3898-RRProject Type: HATCH
 Agency ID: CSRS Period: 01 OCT 79 to 30 SEP 85

Objectives: Breed improved cultivars of guayule (*Parthenium argentatum*) having a high rubbercontent (15-20%), and develop economical cultural and harvesting procedures with emphasis on growing guayule under minimum water regimes. Domesticate jojoba, (*Simmondsia chinensis* (Link) Schneider) including the development of improved varieties, to establish efficient production and harvesting techniques under minimum water regimes, and conduct economic feasibility studies. Improve guar (*Cyamopsis tetragonoloba*) production under minimum water regimes through the development of high-yielding varieties adapted to such conditions and identify efficient production practices for this species. Identify efficient

exploratory research, additional plant species which hold promise for good performance under saline and limited water regimes.

Approach: Conduct breeding and agronomic research on guayule, jojoba, and guar and conduct exploratory research as specified in the procedures section of project W-157.

Progress: 84/01 to 84/12. Guayule - Agronomic Studies. Hybrids between *Parthenium argentatum* and the 3 tree-like species (*P. schottii*, *P. fruticosum*, *P. tomentosum*) are mostly intermediate in morphology and biomass. Rubber quantity is also intermediate, but they inherited high molecular weight rubber. F(2)'s and backcrosses are being evaluated. 20 USDA guayule lines showed significant differences in rubber content between and within most lines. The high-rubber selections are being increased for further evaluation. Second-cycle cold tolerant guayule plants at Palmdale with high-rubber were identified and will be further increased and evaluated. Cold tolerance is also being incorporated into guayule by hybridization with *P. alpinum*, and other northern species. Guayule - Tissue Culture. Protoplasts were prepared enzymatically from cultured shoots and leaves of *P. argentatum*, with yields near 1 million cells per gram of 3-day-old cultures. Also established were tissue cultures of 2 low rubber producing, but rapidly growing species, *P. confertum* and *P. bipinnatifidum*. Parasexual hybridization between these and *P. argentatum* is being attempted through protoplast fusion. Jojoba. A strain of jojoba was developed that has 62% oil content. This represents a 20% increase in oil since all commercially available materials now have 50-52%. The new strain has additional desirable characteristics.

Publications: 84/01 to 84/12

- HASHEMI, A, WEST, J.E. and YOUNGER, V.B. 1984. Pollen fertility and chromosomal pairing in guayule interspecific hybrids. 5th Ann. Guayule Rubber Soc. Conf., Washington, D.C., June 18-21, 1984. (Summary)
- NAQVI, H.H., KHAIR, M. and YOUNGER, V.B. 1984. Breeding potential of variability in rubber and resin contents among guayule lines at the University of California, Riverside. 5th Ann. Guayule Rubber Soc. Conf., Washington, D.C.
- NAQVI, H.H., DAVEY, J., YOUNGER, V.B., FLORES, G. and RODRIGUEZ, E. 1984. Interspecific hybridization in *Parthenium*. 5th Ann. Guayule Rubber Soc. Conf., Washington, D.C., June 18-21, 1984. (Summary)
- NAQVI, H.H. and YOUNGER, V.B. 1984. Guayule-A rubber plant resource of the US-Mexico borderlands. In Ganster, P. and H. Walters (eds.), Proc. UCLA Borderlands Environ. Conf., Sept. 11-14, 1983, UCLA Latin American Center.

04.015 CRIS0069704
GENETICS OF AGRONOMIC AND BRUSHLAND SPECIES IN SEMI-ARID REGIONS

YERMANOS D M; Botany & Plant Sciences; University of California, Riverside, **CALIFORNIA** 92521.
 Proj. No.: CA-R*-BPS-3797-H Project Type: HATCH
 Agency ID: CSRS Period: 22 JAN 76 to 30 SEP 86

Objectives: Introduce sesame and jojoba as crops in U.S. and research their potential in other countries; study genetic environmental factors that determine oil synthesis in seeds to develop methods of modifying vegetable oil composition to better serve consumer needs and expand the spectrum of uses for them; discover or produce new mutants and strains of oil seeds with novel types of oil, protein and other seed components.

Approach: Increase existing germ plasm collections of sesame and jojoba. Evaluate genetic material and select genotypes which could be used as parental material for the development of varieties or for hybridization and selection of new recombinants with desirable characteristics and superior performance. Extensive testing of end products of breeding program to be conducted in the U.S. and abroad.

Progress: 84/01 to 84/12. JOJOBA: The best ten-year-old female and male jojoba plants have been identified. Another group of 200 selected maternal plants have been multiplied by cuttings that have been transplanted in the field. Male plants have been transplanted in selected places in a third field where plants with heavy seeds and high oil % are being grown. Five male plants every 4 rows have been transplanted to an experimental plot where the genetic and environmental variation in several botanical and agronomic characteristics in 9 jojoba strains obtained from different geographic areas are being studied. SESAME: Efforts continued to develop male sterile lines of sesame. Strains derived from backcrosses were selfed, so that the plants do not carry the male sterility genes can be rogued out. Dr. D. M. Yermanos passed away during the last quarter of 1984. During 1985 it is anticipated that Dr. M. L. Roose will continue the sesame work, including the conclusion of a 3-year NSF grant on sesame research. No final decision has been made on any continuation of the jojoba research.

Publications: 84/01 to 84/12

- MOSJIDIS, J. and YERMANOS, D. 1984. Maternal effects and cytoplasmic inheritance of oleic and linoleic acid contents in sesame. *Euphytica* 33:427-432.
 MOSJIDIS, J. and YERMANOS, D. Plant position effect on seed weight, oil content, and oil composition in sesame. *Euphytica*. Accept. for pub.

04.016 CRIS0076990
THE ARTHROPOD ASSOCIATES OF JOJOBA (SIMMONDSIA CHINENSIS)

PINTO J D; Economic Entomology; University of California, Riverside, **CALIFORNIA** 92521.
 Proj. No.: CA-R*-ENT-3655-H Project Type: HATCH
 Agency ID: CSRS Period: 01 OCT 78 to 30 SEP 85

Objectives: Determine the arthropod species important to the economy of jojoba (*Simmondsia chinensis*) and study their life histories, phenologies, parasites and predators.

Approach: Populations of jojoba will be sampled from various parts of its geographic range in the Southwest. Collections of arthropods will be made by conventional means, curated, and then sent to various specialists for identification. Life history data will be accumulated through both field and laboratory studies.

Progress: 84/01 to 84/12. This project remains in the final stages of completion. The major study yet to be finalized is a complete faunal analysis of all phytophagous species of arthropods occurring on jojoba in California, Arizona and Mexico. Completion of the study has awaited return of specimens sent to specialists for identification. This material will soon be returned, and completion of the work will follow promptly. While waiting for the return of specimens work has focused on gathering, and in many cases, translating existing jojoba literature, and on organizing data from material that has been returned.

Publications: 84/01 to 84/12

- PINTO, J.D. and FROMMER, S.I. 1984. Laboratory and field observations of the life history of *Epinotia kasloana* McDunnough (Lepidoptera: Tortricidae: Olethreutinae), a moth feeding on jojoba (*Simmondsia chinensis* (Link))

04.017 CRIS0048600
SHORT-RUN SUPPLY, DEMAND, AND PRICE ANALYSIS

COLLINS K; EVANS S; VAN MEIR L; Economic Research Service, Washington, **DISTRICT OF COLUMBIA** 20250.
 Proj. No.: NED-SD&PA-4175 Project Type: INHOUSE
 Agency ID: ERS Period: 01 OCT 82 to 30 SEP 83

Objectives: Analyze supply and use of major field crops by focusing on short-run price formation, quarterly feed-livestock relationships, and shifts in end-use demand.

Approach: Develop quantitative forecasting models that emphasize direct causality as contrasted to development of structural models. Focus on where there have been problems of forecast accuracy. Coordinate the model development to include livestock and relationships with variables pertaining to the macro economy.

Progress: 82/10 to 83/09. In-depth analyses of the factors underlying supply, use, and price formation of major field crops was

conducted. The 1983 crop programs, especially the payment-in-kind (PIK) program prevented some planned analyses from being completed, such as estimation of feed-livestock relationships. However, a large volume of unplanned articles, staff assignments, and speeches related to policy and policy impacts were completed. These included analyses of farmers' net returns from program compliance, proposals for operating the PIK program, decision criteria for selecting whole base bids, alternatives for meeting PIK deficits, analyses of the 1984 farmer-owned reserve, and policy options for 1984 programs. In addition, special analyses on tobacco consumption trends and descriptions of the rapeseed and jojoba markets were completed.

Publications: 82/10 to 83/09

- EVANS, S. (1983). An economic analysis of the 1982 cotton acreage reduction program and implications for 1983. Proceedings, Beltwide Cotton Conference (January) 15pp.
- COLLINS, K. (1983). Cotton comparative advantage and policy in the 1980's. Proceedings, Beltwide Cotton Conference (January) 13 pp.
- CLAFFEY-STUCKER, B. (1983). Impact of the 1983 program on ending stocks by type, Rice Outlook and Situation, RS-41 (March) pp. 10-11.
- COLLINS, K. and SCHIENBEIN, A. (1983). analysis of the 1983 wheat program, Wheat Outlook and Situation, WS-263 (February) pp. 12-16.
- EVANS, R.S. (1983). An economic analysis of the 1983 upland cotton program, Cotton and Wool Outlook and Situation, CWS-34 (MARCH) pp. 15-17.

04.018 CRIS0088597
HYDROCARBONS, OILS & LIQUID WAX FROM PLANTS-A PRELIMINARY LISTING OF PLANTS SUITABLE FOR ENERGY FARMING IN FLORIDA

DEHGAN B; Ornamental Horticulture; University of Florida, Gainesville, FLORIDA 32611.
 Proj. No.: FLA-DRH-O2284-BI Project Type: STATE
 Agency ID: SAES Period: 01 JAN 82 to 31 DEC 83

Objectives: To acquire, select and evaluate, plant species with the potential for producing seed oils, liquid waxes and whole-plant soils (terpenoids and polyterpenes-hydrocarbons).

Approach: Establish, an International Seed Program to obtain and exchange initial materials. Obtain seeds/specimens by field expeditions to areas climatically similar to that of Florida. Propagate seeds on vegetative materials in greenhouses. Select species to be included in further trials, based on preliminary growth performance, irrigation and fertilizer requirements on overall agricultural management practices. Conduct field trials of selected species and determine fresh and dry weights (total biomass). Perform chemical analyses to determine molecular weights of hydrocarbons; percent cellulose lignin and extractives; proximate analysis to include percent volatile matter, fixed carbon, water and ash; ultimate analysis to determine percent

carbon, hydrogen, oxygen and nitrogen. Analyze data to determine significance of treatment/species interaction in recommending cultivation of a given taxon.

Progress: 81/07 to 83/06. Most of the hydrocarbon plants reported in the literature are not suitable for cultivation under Florida conditions. Preliminary results of field and greenhouse trials have indicated two species; *Euphorbia tirucalli*, which is suitable only for south Florida and *Asclepias curassavica* which has shown promise for the entire state. The hydrocarbon content of *E. tirucalli* increases with age of the plants (8.19-11.90%), whereas, that of *A. curassavica* is influenced positively by fertilization (3.62%) and negatively by supplemental irrigation (2.75%). A comparison between the results of field trials with *A. curassavica* in Florida and *E. lathyris* in California shows similar biomass yields under unirrigated conditions, despite 3.6 to 7.8 times greater nitrogen application for *E. lathyris*. Because of environmental conditions in Florida, *E. lathyris* is not capable of good growth. It is suggested that future research on hydrocarbon plants show concentrate on selection of individuals or species with vigorous, upright growth habits, low fertilizer-irrigation requirements and high hydrocarbon contents.

Publications: 81/07 to 83/06

- DEHGAN, B. and WANG, S.C. 1983. Evaluation of hydrocarbon plants suitable for cultivation in Florida. Soil Crop Sci. Soc. Florida Proc. 42:17-19.

04.019 CRIS0076992
CULTURAL STUDY OF JOJOBA (SIMMONDSIA CHINENSIS, S. CALIFORNICA) IN HAWAII

COOIL B J; LONG C R; Botany; University of Hawaii, Honolulu, HAWAII 96822.
 Proj. No.: HAW00685-S Project Type: STATE
 Agency ID: SAES Period: 01 OCT 81 to 30 SEP 84

Objectives: Determine the feasibility of jojoba cultivation on the island of Hawaii. Establish the optimum clones for Hawaii. Develop methods of propagation suitable to Hawaii.

Approach: Evaluation of plants established at the Lalamilo Experiment Station farm will be continued using tests for moisture and nutritional requirements. Randomized block factorial comparisons will be made if tests indicate the need. This will be decided on the basis of evaluation of appearance, growth, nutritional status and yield. Individual plants of superior oil quality and yield will be cloned. propagation methods will include grafting female scions to male rootstocks and airlayering.

Progress: 81/01 to 81/12. The primary objective of this experiment was to determine the suitability of the island of Hawaii for jojoba cultivation. After six years and three months as of September 30, 1984 that objective has been met. Fruiting female plants have been produced starting in the fourth year giving a

good yield of healthy seeds. Out of the 187 original plants 116 were lost due to nematode girdling. Only 14 of the remaining 71 plants are fruiting female plants. One of these plants is vastly superior to the others in yielding 610 gm dried nuts compared to 140 gm for the next highest yielding plant. The one plant is insufficient to carry out the secondary objective of establishing the optimum clones, so no propagation has been attempted. The most important cultural practices learned were moisture and nematode control. The rainfall must be supplemented with irrigation so that the roots are not dried, but kept well aerated. Deep watering twice a week was satisfactory after two years. There was not any fertilizer response for these soils. There was a high resistance to insect and wind damage. A new experiment would be necessary using these cultural practices to produce enough plants for developing the best clones for Hawaii.

Publications: 81/01 to 81/12

NO PUBLICATIONS REPORTED THIS PERIOD.

04.020 CRIS0001208
**PRODUCTION AND MANAGEMENT OF PERENNIAL
 MEDICINAL AND SPECIAL PURPOSE CROPS**

SEKIOKA T T; Horticulture; University of Hawaii, Honolulu, **HAWAII** 96822.
 Proj. No.: HAW00804 Project Type: STATE
 Agency ID: SAES Period: 23 DEC 63 to 30 SEP 84

Objectives: To study field management for jojoba, eruthroxyton, and other crops and to determine systems of management for Hawaii. To conduct in vitro studies that relat to propagation of these plants and to develop methods for rapid vegetative multiplication. To collect and study under cultivation perennial tropical plants of potential economic value.

Approach: To modify crop management practices which include propagation methods, planting densities, pruning methods, fertilizing, irrigation, and growth regulators to improve biological efficiency. To evaluate the effect of media components and culture storage conditions on multiplication of plants. To introduce and evaluate potential new crops under field conditions.

Progress: 84/01 to 84/12. A field experiment to determine the influence of growth regulators on the development of floral buds after initiation was conducted at the HC & S site. Gibberellin at 100, 200, and 500 ppm and ethephon at 500, 1000, and 2000 ppm were applied to floral buds as a paste or spray. Growth regulators applied as a paste increased flower development as compared to spray application. This was similar to earlier results from trials conducted under greenhouse conditions. Gibberellin was more effective than ethephon in the development of the male and female flowers. Jojoba plantings are being observed at eight sites throughout the State to determine the suitable ecological zones for cultivation. A significant observation was made at the HC & S site. This was the first observation of heavy fruiting of jojoba below

300 meter elevation. The HC & S site is at approximately 30 meter elevation. Based on our experience and published reports, only sporadic fruiting was expected at low elevation sites in Hawaii.

Publications: 84/01 to 84/12

NO PUBLICATIONS REPORTED THIS PERIOD.

04.021 CRIS0095976
PRODUCTION AND MANAGEMENT OF JOJOBA

SEKIOKA T T; Horticulture; University of Hawaii, Honolulu, **HAWAII** 96822.
 Proj. No.: HAW00804-H Project Type: HATCH
 Agency ID: CSRS Period: 01 OCT 85 to 30 SEP 88

Objectives: To select the most suitable parent stock from the standpoint of production, quality, and adaptation to Hawaiian growing conditions. To develop techniques for vegetative propagation and compare the efficiency of the various propagation techniques. To select the most suitable site for establishing new plantings including the environmental modifications necessary to establish vigorous plantings that are productive. To develop methods for controlling flowering.

Approach: To evaluate seedlings and clonal material introduced from Mexico, Arizona and California based on nut yield and plant growth habit. To evaluate the mineral nutrition and disease control of jojoba cuttings under mist and to conduct in vitro studies that relate to propagation. To evaluate growth and yield performance of jojoba plantings at different sites. To evaluate the effect of water stress and growth regulators on flower bud dormancy.

04.022 CRIS0055150
GENETIC IMPROVEMENT OF FRUIT AND OILSEED CROPS

JANICK J; Horticulture; Purdue University, West Lafayette, **INDIANA** 47907.
 Proj. No.: IND065014 Project Type: HATCH
 Agency ID: CSRS Period: 01 OCT 84 to 30 SEP 89

Objectives: The selection of superior apple and pear clones for desirable horticultural characters and disease resistance. Evaluation of tissue culture systems for improvement of fruit and oilseed species.

Approach: Seedlings and breeding lines of apple and pear from controlled crosses will be screened for desirable pomological and horticultural qualities and for field resistance to diseases such as fireblight, cedar apple rust, powdery mildew, scab and leaf spot. Promising selections will be evaluated in second-test plantings and for geographical adaptability and commercial use in cooperating research stations. In vitro systems will be developed to improve fruit and oilseed species including induction of asexual embryogenesis, development of asexual embryos toward

precocious germination and towards maturity, organogenesis from cells and calli, and meristem and shoot tip proliferation.

Progress: 84/01 to 84/12. Thirty-two selections of pear (*Pyrus* spp) were made in 1984 and 21 additional clones were held for further evaluation. Two selections 448-2 (US 386 x N.J. 3) and 046-77 (N.J. 1 x Okusankichi) are considered promising from 2nd-test plantings and will be propagated for grower testing. Axillary branching of the cotyledonary node of cacao (*Theobroma cacao*) was induced by 6-benzylamino purine in vitro but these proliferated shoots did not grow or further proliferate when detached from cotyledons under a wide range of media or hormonal treatments. The induction of a sexual embryogenesis form embryogenically-competent callus was clone specific and increased as compared to basal medium by auxin, gibberellic acid, proline, nitrogen source, adenine sulfate, carbon source and concentration. Embryogenically-competent callus of jojoba (*Simmondsia chinensis*) has been selected from immature zygotic embryos. Proliferation via asexual embryogenesis is sustained with exposure to 2,4-D; embryos development proceeds when transferred to auxin-free medium. Development of asexual embryos is maximal on agar-gelled medium with sucrose increased to 9% with in vitro wax production averaging 19 mg per embryo at 12 weeks (18% gram dry weight) with some embryos reaching 214 mg (30% gram dry weight). In vitro propagation techniques have been established for *Cuphea wrightii* and *Borage officinalis*.

Publications: 84/01 to 84/12

- WRIGHT, D.C., JANICK, J. and HASEGAWA, P.M. 1984. Temperature effects on in vitro lipid accumulation in asexual embryos of *Theobroma cacao* L. *Lipids* 18:863-867.
- WRIGHT, D.C., KONONOWICZ, A.K. and JANICK, J. 1984. Factors affecting in vitro fatty acid content and composition in asexual embryos of *Theobroma cacao* L. *J. Amer. Soc. Hort. Sci.* 109:77-81.
- KONONOWICZ, A.K. and JANICK, J. 1984. In vitro development of zygotic embryos of *Theobroma cacao*. *J. Amer. Soc. Hort. Sci.* 109:266-269.
- KONONOWICZ, H., KONONOWICZ, A.K. and JANICK, J. 1984. Asexual embryogenesis via callus in *Theobroma cacao* L. *Z. Pflanzenphysiol.* 113:347-358.
- KONONOWICZ, H. and JANICK, J. 1984. Response of embryogenic callus of *Theobroma cacao* L. to gibberellic acid and inhibitors of gibberellic acid synthesis. *Z. Pflanzenphysiol.* 13:359-366.

Objectives: To determine whether incorporation of jojoba meal into the diet of sheep or poultry produces toxic effects.

Approach: The meal and a control will be fed as a feed supplement to four generations of Japanese quail. Feed acceptance, intake, weight gain, and egg hatchability will be assessed. Undetoxified meal will be fed to ruminants (initially sheep) in progressively larger percentages. Effects of pelleting on diet will be studied. Undetoxified meal will also be assessed as a supplement to fish rations. Sacrificed animals will be examined for tissue lesions using light microscopy. Blood and excreta will be examined for mutagens using Ames Salmonella Assay. Methods will be explored to develop a reliable analysis for simmondsin in tissue.

Progress: 84/01 to 84/12. Jojoba nuts grow natively and are being actively planted in the western desert areas. The oil expressed from the nuts is a substitute for whale oil, having similar high temperature industrial applications. The meal remaining contains about 30% protein and could be useful as a farm animal feed supplement. A toxicant, simmondsin, in it, however, is of concern. A feeding study was conducted this year with 40 ram and ewe lambs fed 5 and 10% jojoba meal in their rations or 48-80 days. A few abnormalities in their blood chemistry profile and hepatic microsomal enzyme titer were observed at the 10% feeding level. Some tissue lesions were found using electron microscopy. Animal weight gains were not significantly different between controls and the 5% jojoba feeding group but they were significantly lower at the 10% level versus controls. Analyses for mutagens in blood and feces and for the toxic principal, simmondsin and its metabolites in tissues is underway. In a related study, it was also found that animal acceptance of the ration was greatly improved if the jojoba meal was ensiled (10%) with corn foliage and then fed in this form.

Publications: 84/01 to 84/12

NO PUBLICATIONS REPORTED THIS PERIOD.

04.023 CRIS0089785
SUITABILITY OF JOJOBA NUT MEAL AS A FEED
SUPPLEMENT

LISK D J; Agronomy; Cornell University,
Ithaca, NEW YORK 14853.
Proj. No.: NYC-125325 Project Type: STATE
Agency ID: SAES Period: 01 MAR 83 to 30 SEP 86

05.001 CRIS0007937
CROP SELECTION AND MANAGEMENT IN SOUTHWESTERN
ARIZONA

JACKSON E B; Plant Science; University of
Arizona, Tucson, ARIZONA 85721.
Proj. No.: ARZT-101739-S-25-129
Project Type: STATE
Agency ID: SAES Period: 01 JUL 77 to 30 JUN 83

Objectives: Investigate cultural practices which might facilitate earlier harvest of winter crops to permit more timely planting of summer crops on the same land. Investigate new drops or cultivars which offer possibilities for the summer months from June through October. Investigate the possibility of interplanting summer crops in wheat or barley to give them an earlier start.

Approach: Cultural practices which might facilitate earlier harvest of winter crops will include: Swathing of small grains, safflower and other seed crops at physiological maturity; desiccation of these crops with harvest-aid chemicals and other practices suggested by the results of the research. Possible summer crops include kenaf for both forage and fiber, varieties of dry beans, soybeans, guar, sweet sorghum, grain sorghum, sudan grass, corn and others. Sorghum, corn or soybeans will be interplanted in wheat and barley in February or March to continue growth after harvest of the grain.

Progress: 83/01 to 83/06. Wheats and triticales for double-cropping with cotton. Fifty-eight named varieties and experimentals of bread wheats, durums and triticales were selected from previous tests for earliness of maturity. Replicated trials were planted in mid-November 1982. Differences in earliness among bread wheats, durums and triticales were insignificant. Earliest entries in all categories were physiologically mature around 20 April and ready to combine around 29 April. Bittern and Yecora Rojo were typical early wheats. Small grains yield comparisons: Plantings were completed 20 Dec 1982, irrigated 3 times in addition to 9 cm rainfall during the growing season, and fertilized with a total of 168 kg N/ha. Highest yields in kg/ha were: Hard Red bread wheats: C79-97=8750; C79-268-1=8110; Westbred=8070; Yolo=7960; Glennson=7830. Hard White bread wheats: SGW-012=8180; SGW-022=8050; Nacozari 76=8010; Yecorato 77 and Vireo "S"=7920; M77-30=7740. Durum wheats: Yavaros 77=7740; E28-1"S"78-7910; Bittern "S" and Cando-7570; Gem H2001=7730; Aldura=7580. Barleys: BFP-78-40C=8120; Columbia and BFP79-18=7880; Gustoe=7570; AZ76-15-1=7530; Sunbar 409=7380. Evaluation of garbanzo beans for Yuma. The planting date of 6 January was too late and resulted in diseased plants. A selection made in Yuma and designated "Yuma" was most disease tolerant. UC 5 was fairly tolerant, Mission was less tolerant. From this late planting, first flowers were 15 March, beans mature by 6 May.

Publications: 83/01 to 83/06
NO PUBLICATIONS REPORTED THIS PERIOD.

05.002 CRIS0066578
SALINITY AND SALT TOLERANT PLANTS

EPSTEIN E; LAUCHLI A E; Land, Air & Water
Resources; University of California, Davis,
CALIFORNIA 95616.
Proj. No.: CA-D*-LAW-3193-H Project Type: HATCH
Agency ID: CSRS Period: 20 SEP 74 to 30 SEP 86

Objectives: Identify among existing genotypes, or to generate by breeding, genotypes of plants tolerant of salinity. Compare physiological, biochemical, and structural features of these plants with those of their salt sensitive relatives. Emphasis will be on Objective 2.

Approach: There being a vast array of responses that plants may make to salinity, choices have to be made as to which responses to concentrate on. In this project, emphasis will be on ionic relations: Absorption, distribution, and partitioning of sodium, chloride, potassium, calcium, and possibly other ions in the plant, down to the level of the tissue and the cell.

Progress: 84/01 to 84/12. Experiments have been devoted to both genetic and physiological aspects of the responses of plants to salinity, and the interplay between these aspects. About 200 lines of hexaploid wheat, 50 of barley, and a few lines of triticale have been screened for salt tolerance in salinized nutrient solutions. The results are still being evaluated. Triticale lines varied markedly in germination under saline conditions (200 mM NaCl); one performed at essentially control (no salt) level. One of the other lines benefited by inclusion of an elevated calcium concentration in the medium (5.0 instead of 0.4 mM). In corn, lowering the oxygen tension (aeration) in the root medium interfered with mechanisms that retain sodium in the roots, with simultaneous inhibition of potassium transport, thereby permitting more potentially harmful sodium to reach the shoots. In salt-stressed sorghum, chloride was partitioned into sheaths and midribs and away from the photosynthetic leaf tissue, in contrast to the more salt-sensitive corn that did not show chloride partitioning. Specific ion effects are also pronounced in the responses of kenaf, a fiber plant, to salinity, as determined in field experiments in the Imperial Valley. This report of necessity is sketchy but two conclusions stand out: genetic differences in the responses of plants to salt, even within a species, are often marked, and in addition to water relations, specific ion effects often play decisive roles in these responses.

Publications: 84/01 to 84/12
KINGSBURY, T.W. and EPSTEIN, E. 1984.
Selection for salt-resistant spring wheat.
Crop Sci. 24:310-315.
KINGSBURY, R.W., EPSTEIN, E. and PEARCY, R.W.
1984. Physiological responses to salinity
in selected lines of wheat. Plant Physiol.
74:417-423.
BLOOM, A.J. and EPSTEIN, E. 1984. Varietal
differences in salt-induced respiration in
barley. Plant Sci. Letters 35:1-3.
NORLYN, J.D. and EPSTEIN, E. 1984.
Variability in salt tolerance of four
triticale lines at germination and

emergence. Crop Sci. 24:1090-1092.
 LAUCHLI, A and EPSTEIN, E. 1984. Mechanisms of salt tolerance in plants. Calif. Agric. 38(10):18-20.

05.003 CRIS0083516
 DEVELOPMENT OF NEW AND IMPROVED CROPS FOR WATER CONSERVATION IN ARID LANDS

LAUCHLI A E; ROBINSON F E; Land, Air & Water Resources; University of California, Davis, CALIFORNIA 95616.
 Proj. No.: CA-D*-LAW-4086-RR Project Type: HATCH
 Agency ID: CSRS Period: 06 MAR 81 to 30 SEP 85

Objectives: To evaluate species of Cruciferae which will produce useful products under minimum water regimes and to develop effective production practices for such species (Arizona, California at Davis, Montana, New Mexico). To identify, through exploratory research, additional plant species which hold promise for good performance under saline and limited water regimes (Arizona, California).

Approach: Species and lines of Brassica and Eruca will be screened for drought tolerance and evaluated for responses to irrigation with high and low quality water. Cultivars, lines and introductions of Kenaf (*Hibiscus cannalinus* L.) will be screened for salt and drought tolerance and evaluated for responses to irrigation with high and low quality water.

Progress: 84/01 to 84/12. Work on the potential for cultivation of kenaf in Imperial Valley using low-quality water was continued. Eight lines were grown for comparison of adaptability and yield in lower desert conditions. Maxima in yields of 25.8t/ha (line Tainung) in 1983 and 24.2 t/ha (E 41) in 1984, using Colorado River water for irrigation, offer promise of commercial development in Imperial Valley. In Greenhouse experiments the physiology of salt stress responses in kenaf was continued to be evaluated. Growth was analyzed using the methods of mathematical plant growth analysis. Growth reduction was correlated with reduction in total leaf-area and leaf area partitioning without a detrimental effect on photosynthesis. Ion analysis showed an increase in Na and Cl, with expanding leaf tissue containing lower concentrations than mature leaves. Pressure-volume analysis to study turgor maintenance during salt stress is in progress. A manuscript has been submitted to Crop Science. Some of these data were presented at an International conference in Israel, 1984.

Publications: 84/01 to 84/12

LAUCHLI, A. and F.E. ROBINSON. 1984. Development of New and Improved Crops for Water Conservation in Arid Lands. Annual Report, Regional Project W-157. 3 pages.
 LAUCHLI, A., P.J. BOURSIER and P.S. CURTIS. 1984. Assessing salt and water stress in crops under irrigation with low-quality water. In: Proc. Int. Conf. on Soil Salinity Under Irrigation - Processes and Management, Bet-Dagan.

CURTIS, P.S. and LAUCHLI, A. 1984. The effects of salinity on growth, ion accumulation, water relations, and photosynthesis in Kenaf. Agronomy Abstracts 1984, p. 102.

05.004 CRIS0087132
 EVALUATION OF GRASSES, LEGUMES & OTHER CROPS FOR BIOMASS PRODUCTION UNDER VARIOUS PRACTICES

OVERMAN A J; Agric Research & Education Cntr, Bradenton, FLORIDA 33508.
 Proj. No.: FLA-BRA-02177-BI Project Type: STATE
 Agency ID: SAES Period: 01 JAN 81 to 30 SEP 84

Objectives: Identify new crops grasses, legumes, etc.) and management practices for biomass production.

Approach: Identify cultivars (e.g., beet, sorghum, native grasses/shrubs, legumes and companion agronomics) and collect seed supplies for candidate species; establish field evaluation plots; determine feasibility of multicropping; evaluate susceptibility to pests and, where possible, test and develop controls.

Progress: 83/10 to 84/09. A slime pit in the Bartow area has been planted for 3 years with a variety of agronomic crops as part of a reclamation program. Nematode assays made in October 1983 and 1984 at harvest of summer plots indicated that high populations of spiral nematodes (*Helicotylenchus pseudorobustus* and *H. dihystra*) were associated with white or alyce clover, and the stunt nematode (*Tylenchorhynchus martini*) with red clover. The only plant nematode associated with kenaf was a high population of *H. pseudorobustus*. Only the ring nematode (*Criconeoides curvatum*) were abundant in soil collected from rhizospheres of napiergrass, and alemangrass. *Leucaena* supported the fewest nematodes of the crops. There was no differences in the populations of nematodes in the rhizosphere of field corn, sunflower, or soybean; moderate numbers of *H. pseudorobustus* and *T. martini* were present in October.

Publications: 83/10 to 84/09
 NO PUBLICATIONS REPORTED THIS PERIOD.

05.005 CRIS0087131
 BIOMASS PRODUCTION FROM UNCONVENTIONAL FORAGE CROPS AND INTRODUCED PLANT SPECIES

PRINE G; Agronomy; University of Florida, Gainesville, FLORIDA 32611.
 Proj. No.: FLA-AGR-02176-BI Project Type: STATE
 Agency ID: SAES Period: 01 JAN 81 to 31 DEC 84

Objectives: Identify and evaluate unconventional crops and plants introduced from other countries for biomass production and culture them in ways to maximize biomass yield.

Approach: Identify potential species and obtain seeds through U.S.D.A. Plant Introduction Program; establish field plots to evaluate relative biomass yields-initial emphasis on

croton, pigeonpeas, sesbanias, tropical sorghum, kenaf, napiergrass, leucaena, and wild-type sugar cane; increase seed supply of promising species for larger field plot evaluations; explore cropping systems compatible with environmental requirements.

Progress: 83/10 to 84/09. The average dry matter yield of the top 12 yielding accession of leucaena (*Leucaena* spp.) over 2 growing seasons was 29.3 and 24.7 Mg ha⁻¹. The top yielding leucaena accession K-8, had energy content and dry matter yields equivalent to 17.9 and 11.8 Mg oil ha⁻¹ for the two seasons. Oven dried leucaena stems had energy contents varying from 19.3 to 20.1 joules Mg⁻¹. Potassium, Ca and Mg contents varied between leucaena accessions ranging from 0.49 to 0.72, 0.22 to 0.41, and 0.05 to 0.11 dag Kg⁻¹, respectively. Elephantgrass (*Pennisetum purpureum*) cultivar trials were lead by PI 300086 at Dairy Research Unit (DRU) at Gainesville with a yield of 39 Mg ha⁻¹. This accession produced an average annual top growth dry matter yield of 48 Mg ha⁻¹ over a three-year period at the Energy Park. PI 300086 had the lowest percentage of lodging among the 11 elephantgrass accessions tested at the DRU. During a twenty-four week period in a cutting frequency experiment PI 300086 elephantgrass fertilized with 336 kg ha⁻¹ of nitrogen, has total dry matter yields of 13.7, 16.2, 21.0, and 32.3 Mg ha⁻¹ at 6-, 8-, 12-, and 24-week cutting intervals, respectively. In another experiment where nitrogen levels varied from none to 67.2 Kg ha⁻¹, PI 300086 elephantgrass harvested once a season, had its highest dry matter yield (46 Mg Ha⁻¹) at the 224 Kg ha⁻¹ N rate.

Publications: 83/10 to 84/09

OTHMAN, A.B. and PRINE, G.M. 1984. Leucaena for biomass in humid subtropics. *Agronomy Abst.* 1984 Annual Meeting ASA at Las Vegas. p. 134.

05.006 CRIS0041882 INTRODUCTION, EVALUATION AND MAINTENANCE OF CROP GERMLASM - SOUTHERN REGION

LOVELL G R; ADAMSON W C; Plant Introduction Res; Agricultural Research Service, Experiment, GEORGIA 30212.
Proj. No.: 6607-20160-001-00D

Project Type: INHOUSE
Agency ID: ARS Period: 15 NOV 74 to 15 NOV 85

Objectives: Regional activities in a coordinated national plant germplasm introduction system. Introduce, multiply, evaluate, catalogue, maintain, and distribute germplasm of plant introductions for improving crops in the Southern Region.

Approach: Foreign introductions of plant germplasm will be introduced through the Germplasm Resources Laboratory ARS-Beltsville. Increase and maintenance of collections will be accelerated through cooperative projects with University Plant Scientists. Selection for resistance to major crop diseases (anthracnose of sorghum & bacterial spot of pepper

(*Capsicum*) will be carried out with new large collections of these crops. Legumes will be screened to determine levels of ability for nitrogen-fixation.

Progress: 82/01 to 82/12. Germplasm of 3,171 new introductions from 30 countries was added to the regional plant germplasm collections. These new collections were composed of 36 genera and 40 species. The major crops included were sorghum, cowpeas, mung beans, millets and peanuts. A total of 4,741 introductions were grown at the regional station and other locations for seed increase and evaluation. Distribution of germplasm continued at a high level with 10,483 seed packets shipped in response to domestic requests and 8,757 packets in response to requests from 62 countries. In the isolated increase field of new peanut introductions a mosaic virus was observed that was proven to be other than the common mosaic mottle virus of peanuts. Head-mold of sorghum (a complex of *Fusarium*, *Curvularia* and *Helminthosporium* species) can reduce seed germination to zero. Preliminary trials have indicated that treating seed with a chlorine formulation can increase germination 35-100%. Through tests for relative resistance to anthracnose of watermelon it was concluded that greenhouse tests alone can be inaccurate in determining resistance in some plant introductions. Utilization of our plant germplasm Data Base system was improved with a CRT unit and printer. In addition, a dedicated line through GTE Telenet Services has been installed to enable our terminal to interact with the computer of the National Plant Germplasm System at the Beltsville Agricultural Research Center.

Publications: 82/01 to 82/12

ADAMSON, W.C., PRINE, G.M., LONG, F.L. and MCQUIRE, J.A. 1982. Removal of nitrogen and potassium of kenaf. *Tappi Non-wood Plt. Fiber Pulping Rept.* 13:1-4.
CAMPBELL, T.A. and ADAMSON, W.C. 1982. Responses of Kenaf to Selected Herbicides and Herbicide Combinations. *Tappi Non-wood Plt. Fiber Pulping Rept.* 13:99-103.

05.007 CRIS0046406 USE OF SALINE WATERS FOR GROWTH OF TROPICAL CROP PLANTS

MAAS E V; SIEGEL S M; Botany; University of Hawaii, Honolulu, HAWAII 96822.
Proj. No.: 5310-20730-003-02S

Project Type: COOPERATIVE AGREE.
Agency ID: ARS Period: 16 JUL 80 to 15 APR 85

Objectives: Assess the potential of agronomic and horticultural tropical plants using salinewaters for irrigation.

Approach: Determine the salt tolerance of selected economic, tropical plants; evaluate physiological responses to salinity as markers for saline stress and adjustment or adaptation; select and develop new salt-tolerant individuals or cultivars and determine potential for chemical modifications or amendments to the saline irrigation system to

reduce nutritional imbalance and stress.

Progress: 83/01 to 83/12. Papaya were grown hydroponically in solutions salinized with artificial sea salt up to an equivalent of 80% sea water. Chemical analysis indicated that papaya effectively excludes Na from the leaves by sequestering it in roots and stems. Sodium accumulation in the stems was accompanied by increased stem diameter and succulence. Considerably less Cl was taken up than Na in any tissue analyzed indicating Cl transport is controlled at the plasmalemma of roots. Salt concentrations above 30% sea water were lethal. Flowering and fruit set occurred at 7.5% sea water but all fruit abscised prematurely. At 15% sea water, flowers abscised before fertilization. Chlorophyll a and b increased per unit leaf area with increased salinity -- the chlorophyll a:b ratio decreased.00

Publications: 83/01 to 83/12

KOTTENMEIER, W., CHANG, H., SIEGEL, S.M. and SIEGEL, B.Z. 1983. Stimulation of growth in papaya and other plants by dilute salt solutions. Water, Air, and Soil Pollution 20:447-450.

05.008

CRIS0046549

PLANT COMPONENT SEPARATION AND PHYSICAL CHARACTERIZATION

ABBOTT T P; GREENE R V; CARR M E; Biomaterials Conversion Lab; Northern Regional Res Center, Peoria, ILLINOIS 61604.
Proj. No.: 3620-20560-006-00D

Project Type: INHOUSE

Agency ID: ARS Period: 01 OCT 80 to 01 OCT 85

Objectives: Develop chemical or other innovative means of separating plant materials to study the physical properties of the separated and combined components, leading to a more fundamental understanding of these materials.

Approach: Evaluate solvents and reactive gasses of various solubilities for their ability to separate lignin, cellulose and other plant constituents by extraction and diffusion studies. Relate the extraction results to the associative forces binding plant materials. Determine the thermal (DTA, DSC, etc. analysis) and rheological properties (Mechanical Spectrometer, Plasticorder) of the components and combinations of selected or modified plant materials.

Progress: 83/01 to 83/12. Rates and extent of delignification of kenaf by 12 species of *Cyathus* fungi were determined. Several aspects of the chemical mechanism of alkaline H_2O_2 delignification of lignocellulosics were elucidated, and the efficient conversions of cellulose to glucose and cellulose to ethanol were demonstrated. Lignin is oxidized by the peroxide to short chain mono and dibasic acids and to aromatic acids. Cell membrane vesicles from the lignin-degrading fungus *Phanerochaete chrysosporium* were isolated and a trans membrane glucose/ H^+ transport system was characterized. Extracellular H_2O_2

production by *P. chrysosporium* associated with lignin biodegradation was found to be induced by the presence of lignocellulosics in the culture medium. An active fatty acyl-CoA oxidase activity was discovered in *P. chrysosporium* mycelia which may represent the metabolic source of the excreted H_2O_2 . Sweet sorghum stalks treated with propionic acid and stored under anaerobic conditions showed no loss in sugar content during the first 100 days. Wheat straw in the presence of various chemicals was rapidly modified in single- and twin-screw extruders to yield water extractable lignin and pentosan components and a cellulose residue highly accessible to cellulase.

Publications: 83/01 to 83/12

ABBOTT, T.P. and JAMES, C. 1983. Products of wheat straw biodegradation by *Cyathus stercoreus*. ACS Symposium Series 214, Am. Chem. Soc. 267-284.

ABBOTT, T.P. and JAMES, C. Kenaf lignin ^{14}C -labeling and analysis. Tappi. In press.

BELL, D.H., PATTERSON, L.K. and GOULD, J.M. 1983. Transmembrane pH gradients and functional heterogeneity in reconstituted vesicle systems. Biochim. Biophys. Acta 725:368-375.

CARR, M.E. and DOANE, W.M. Modification of wheat straw in a high-shear mixer. Biotechnol. Bioeng. In press.

GOULD, M.J. 1983. Probing the structure and dynamics of lignin in situ. What's New in Plant Physiology 14(2):5-8.

05.009*

CRIS0044659

INTRODUCTION, EVALUATION, AND PRESERVATION OF NEW CROP SPECIES--NORTH-CENTRAL-REGION

CLARK R L; ROATH W W; Plant Introduction Res; Agricultural Research Service, Ames, IOWA 50010.

Proj. No.: 3808-20160-006-00D

Project Type: INHOUSE

Agency ID: ARS Period: 17 JUL 78 to 30 MAR 85

Objectives: Through evaluation and research for adaptability and cultural requirements, gain new and improved knowledge of the chemical, biological, and agronomic potentials of selected industrial oils, waxes, gums, fibers, of food and feed proteins, and licit and illicit drugs and other medicinals, with emphasis on plants of current interest. Increase seed for distribution for use in experimental plantings and for preservation of germplasm collections.

Approach: Plant materials will be obtained through exploration and introduced for both chemical and cultural evaluation in the search for food, feed, and industrial end-uses which would be the basis for new or replacement crops for the United States. The work may involve cooperation between the Northern Regional Research Center, the State Experiment Stations, and other research institutions in the regions, both as to chemical and cultural problems.

Progress: 82/01 to 82/12. Techniques for increasing Brassica that would improve seed production and minimize outcrossing are being tested. Several accessions of *B. napus* were grown in cages in 1982 with encouraging results as to seed production. More work will be continued under cages in 1983. P.F. Knowles, U.C. Davis, contributed more than 1500 accessions of Brassica to NC-7 over a period of years. In 1982 we sent 64 pounds of *Berteroa incana* seed to the Northern Regional Research Center, Peoria, IL as part of the cooperative work with the Center.

Publications: 82/01 to 82/12
NO PUBLICATIONS REPORTED THIS PERIOD.

05.010 CRIS0043827
IDENTIFICATION OF DISEASE RESISTANCE & PATHOLOGICAL STUDIES ON HORTICULTURAL & OTHER PLANT GERMPLASM

OBRIEN M J; Beltsville Agr Res Center, Beltsville, MARYLAND 20705.
Proj. No.: 1208-20162-009-00D
Project Type: INHOUSE
Agency ID: ARS Period: 25 MAY 77 to 31 MAY 85

Objectives: Identify and document resistances and obtain information on mode of disease transmission, host-pathogen interactions, and other important factors for specific disease organisms on selected plant germplasm of stokes aster, cruciferae, and carrots.

Approach: Develop suitable infectivity techniques to evaluate selected germplasm for resistance to specific disease organisms. Study the developmental morphology of the organisms, determine their infection-requirement parameters, explore their existing genetic stability or their potential mutability, and evaluate host-parasite relationship. Develop cultural methods and media to encourage sexual or alternate-stage development of the organisms. Verify and correlate results of seedling and mature-plant reactions to infection under field or greenhouse conditions.

Progress: 77/02 to 84/10. A strain of *Bacillus subtilis* controlled charcoal rot in vitro and reduced disease incidence in the field, providing a control agent that is effective, inexpensive, and non-hazardous to health. *Diaporthe melonis* sp. nov. was described on market cantaloupes, demonstrating that the imperfect state, *Phomopsis* sp., can occur on cantaloupe fruits and cause destructive soft rot. This research provides a means to identify the disease and an inoculation procedure to evaluate cvs and/or wild P.I.'s for soft-rot resistance. Six P.I. lines had moderate resistance/tolerance to *Fusarium oxysporum* f. sp. *spinaciae* in greenhouse tests of 205 P.I.'s and 19 cvs. P.I. 174384 survived tank tests at 20, 28, and 32 C; it possesses compact growth habit and is a slow bolter. The *Fusarium* wilt organism was isolated from the embryos of seed from inoculated spinach plants, demonstrating that it can be introduced during seeding into spinach-growing fields. Likewise, *Alternaria brassicicola* was

recovered from embryos of seed from field-grown *Crambe* spp. with like premise of field contamination. In evaluation of 473 P.I.'s of *Solanum melongena* for resistance to *Verticillium dahliae*, three showed resistance; two had tolerance. The first report of the occurrence in the U.S. of *Phyllosticta cryptomeria* was made. A genetic-variation study assessed the resistance of 16 cvs and P.I.'s of *Hibiscus cannabinus* to *Botrytis cinerea*; three lines possessed field resistance.

Publications: 77/02 to 84/10
CAMPBELL, T.A. and O'BRIEN, M.J. 1981. Differential response of kenaf to gray mold. *Crop Sci.* 21:88-90.
O'BRIEN, M.J. 1983. Evaluation of eggplant accessions and cultivars for resistance to *Verticillium* wilt. *Plant Dis.* 67:763-764.

05.011 CRIS0057574
ECONOMIC DEVELOPMENT OF REGIONS AND NATIONS

BLASE M G; Agri Economics; University of Missouri, Columbia, MISSOURI 65211.
Proj. No.: MO-00029 Project Type: STATE
Agency ID: SAES Period: 01 JUL 70 to 30 JUN 86

Objectives: To analyze constraints to and facilitators of economic development in Missouri US and developing countries, especially impacted by inflation, the energy crisis and new agricultural products. To formulate development strategies to alleviate these constraints and make maximum use of the facilitators. To advise policy makers with regard to economic development policies.

Approach: A variety of approaches will be taken. When possible, comparative analysis will be made, utilizing the experience of other countries with regard to inflation, reduced research support, and the energy crisis with regard to their impacts on agricultural economic development. In addition, individual economic feasibility studies, regional analyses and national modeling will be undertaken. Conventional techniques such as linear programming and aggregate production function analysis will be used.

Progress: 84/01 to 84/12. Several studies were completed during the year. First, the domestic study will be discussed. Second, several for developing countries will be reviewed. The dissertation simulating the establishment of kenaf as a new crop in U.S. agriculture was completed. Largely as a consequence, the principal investigator was asked to assist with the preparation of a publication on new crops for the Council for Agricultural Science and Technology (CAST). Subsequently, testimony was given to the Joint Economic Committee of Congress concerning these research findings. An analysis of wheat production in Zimbabwe was completed also. It demonstrated the price responsiveness of commercial farmers in that country. The final work completed was a study of semi-subsistence farmers in the Mbeya region of Tanzania. In this case the constraint to increased production was determined to be the crude tool

technology which limits labor productivity, especially during peak labor requiring periods. The Second Edition of Institution Building: A Source Book was accepted for publication by the University of Missouri Press.

Publications: 84/01 to 84/12

BLASE, M.G. and BLASE, L.E. 1984.

"Institution Building in Managing International Development." Managing International Development. Vol. 1, No. 3, pp. 25-38.

BLASE, M.G., et al. 1984. "Development of New Crops: Needs, Procedures, Strategies, and Options." Council for Ag. Sci. and Tech. Report No. 102.

continued. The better varieties of the red kidney, small white, black turtle soup and navy types will be taken to farmers for trial planting. A cut-off date of July 15 must be adhered to so the late planted beans can mature. The major companies of the state are very interested in the test results. A recently released edible sunflower variety has done well at two planting dates in N.C. Yields, as well as seed size and quality are excellent.

Publications: 84/01 to 84/12

LARSON, S.E. 1984. The effect of various fertilizer regimes on the growth and chemical characteristics of *Rhus Glabra* L. M.S. Thesis. N.C. State Univ., Raleigh. p. 63.

05.012 CRIS0002734
PLANT GERMPLASM - ITS INTRODUCTION, MAINTENANCE AND EVALUATION

FIKE W T; PHILLIPS L L; Crop Science; N Carolina State University, Raleigh, **NORTH CAROLINA** 27650.

Proj. No.: NC01009 Project Type: HATCH
Agency ID: CSRS Period: 01 OCT 82 to 30 SEP 87

Objectives: To evaluate introduced plant materials and to maintain and publish records of their performance and use in the Southern Region. To assay plant materials for their chemical and physical properties and to determine cultural requirements of species having new crop potential.

Approach: All PI'S maintained at the regional stations will be available to plant scientists. Progress reports will be made to S-9 on the results of germplasm testing. State cooperators will be informed of all plant collecting trips so that they may funnel specific requests for germplasm to the plant collectors. Those crops growing in other areas and native herbs will be evaluated. Cultural studies will be initiated for any new adapted crop in order to obtain highest possible economic yields.

Progress: 84/01 to 84/12. The effects of various fertilizer regimes of N, P, and K on plant growth, tannin and protein content of smooth sumac (*Rhus glabra*) were evaluated. In all tests percent tannin and protein were inversely related, with N rates being the significant factor for both. At one location the negative effect of N rates on percent tannin offset the increased leaf yields caused by N and N x K interactions. In another location maximum total tannin yield occurred with the addition of 18 kg N ha⁻¹ and 37 kg K ha⁻¹. Conversely, in another test tannin yield was positively influenced by increased N rates. Tannin yield went from 722 to 1075 kg ha⁻¹ as N rates went from 0 to 134 kg ha⁻¹. A syrup sorghum variety test was again evaluated for plant growth characteristics. Most newer varieties perform better than older varieties. They are however extremely tall and difficult to harvest. One variety, Brandes, is shorter, stands well, and can be easily harvested. Under a cooler environment this variety sometimes matures on the late side for proper processing. Tests on dry bean variety traits are being

05.013 CRIS0064864
INVESTIGATION OF PAPERMAKING-TYPE BONDING IN MATS OF UNDEFIBERED LIGNOCELLULOSIC MATERIALS

MCGOVERN J N; SETTERHOLM V C; Forestry; University of Wisconsin, Madison, **WISCONSIN** 53706.

Proj. No.: WIS02052 Project Type: STATE
Agency ID: SAES Period: 01 DEC 73 to 30 JUN 85

Objectives: Determine the strength of papermaking-type bonds in single and cross-banded mats of undefibered pith of corn stalks and kenaf, juvenile and mature wood of hybrid poplar and other lignocellulosic materials. Develop methods for preparing mats and testing their properties.

Approach: The pith of the papyrus plant, comprising fibrovascular bundles and parenchyma cells, develops papermaking-type bonds on mechanical processing, as known historically and determined previously with modern papyrus. The pith of corn stalks and kenaf, similar to papyrus in cell composition, will be sliced on a microtome into strips for controlled mechanical processing with a roller, forming into single and cross-banded mats, pressing and air and press drying. The same technique will be adapted to juvenile and mature poplar wood and other lignocellulosic materials. The mats will be tested for bonding strength by methods used for paper and paperboard and examined microscopically. Insights into the nature of bonding in parenchyma-high materials will be sought.

Progress: 84/01 to 84/12. Experimental investigations of papermaking-type bonding in bark paper (amate') were postponed until spring, 1985, pending procurement of a more adequate supply of local white mulberry inner bark and obtaining a new book on Mexican bark paper. Preliminary bleaching trials on corn stalk pith sections with dilute sodium hypochlorite solution (0.75%) resulted in a cross-laminated mat of creamy white appearance showing reduced resistance to pressing to a thin mat (0.015 mm) with improved flexibility. Overnight bleaching resulted in disintegration of the pith sections, indicating a certain extent of delignification. A "C" clamp was adapted for pressing mats for schoolroom or other demonstrations.

Publications: 84/01 to 84/12

- MCGOVERN, J.N. 1984. Contribution in Section 11, Forest Products Utilization, in Forestry Handbook, 2nd edition, E. Wenger, ed. John Wiley & Sons, N.Y.
- MCGOVERN, J.N. 1984. Fibers, Vegetable in Encyclopedia of Textiles, Fibers, and Nonwoven Fabrics. pp. 172-197. Martin Grayson, ed. John Wiley & Sons, N.Y.
- MCGOVERN, J.N. 1984. India: Earliest Papermaking? Tappi Journal 67, No. 8: 13-14 (Aug.).
- MCGOVERN, J.N. 1984. Centennial of Kraft Process. Tappi Journal 67, No. 11: 48-50 (Nov.).

COM 06 MEADOWFOAM

06.001 CRIS0085698
INTRODUCTION, MULTIPLICATION, MAINTENANCE,
EVALUATION AND CATALOGUING OF PLANT GERM PLASM

WOODING F J; Alaska Plant Materials Center;
University of Alaska, Fairbanks, ALASKA 99701.
Proj. No.: ALK-81-12 Project Type: HATCH
Agency ID: CSRS Period: 01 OCT 80 to 30 SEP 85

Objectives: Cooperate with and participate in, a coordinate national program of foreign and domestic plant exploration for and introduction of, germ plasm potentially valuable for agricultural, environmental, medical and industrial uses in the Western Region. Increase, maintain and distribute seed or other propagules of plant germ plasm for use in research and teaching programs. Promote and engage in evaluative research with introduced plant germ plasm, to stimulate its utilization and aid in reducing genetic vulnerability.

Approach: Plant introductions having origins at northern latitudes or high elevations will be evaluated for their adaptability to the subarctic growing conditions of interior Alaska. Primary emphasis will be given to improving germ plasm for potential new crops.

Progress: 84/01 to 84/12. Thirty-one barley, 12 oat, and 15 wheat cultivars were evaluated in replicated standard trials at Fairbanks and Delta Junction. The Delta Junction site was situated on recently cleared forest land which had been summer-fallowed the previous year. The Fairbanks site was situated on summer-fallowed land which had been in production for about 55 years. Precipitation was adequate for good crop growth at both locations during the 1984 growing season. The cultivars for each grain type were separated into two maturity classes: very early to early, and medium to late. At Fairbanks, the highest yields in each of these crops for the very early to early maturity class were as follows: 'Paavo' barley, 5704 kg/ha; 'Torval' oats, 5273 kg/ha; and 'MS273-150 (ACA2571)' wheat, 6995 kg/ha. The highest yields for each of the crops for the medium to late maturity class were as follows: 'Hankkija's Pokko' barley, 5811 kg/ha; 'Calibre' oats, 6313 kg/ha; and 'Tapio' wheat, 7533 kg/ha. At Delta Junction, the highest yields in each of the crops for the very early to early maturity class were as follows: 'H349-204 (ACA2563)' barley, 6188 kg/ha; 'Athabasca' oats, 6170 kg/ha; and 'Rovaniemi Sel. 70-W' wheat, 5381 kg/ha. The highest yields in each of the crops for the medium to late maturity class were as follows: 'Hankkija's Pokko' barley, 6134 kg/ha; 'Cascade' oats, 6672 kg/ha; and 'Taava' wheat, 6053 kg/ha.

Publications: 84/01 to 84/12

WOODING, F.J., MCBEATH, J.H., FROST, S.,
HANSCOM, J.T., VANVELDHUIZEN, R.M. and
DELUCCHI, G.M. 1984. Performance of cereal
crops in the Tanana River Valley of Alaska,
1983. Agricultural Experiment Station,
University of Alaska,

06.002 CRIS0066784
GERMPLASM DEVELOPMENT AND EVALUATION IN
MEADOWFOAM (LIMNANTHES SPP.)

JAIN S K; Agronomy & Range Science; University
of California, Davis, CALIFORNIA 95616.
Proj. No.: CA-D*-ARS-3115-H Project Type: HATCH
Agency ID: CSRS Period: 01 OCT 85 to 30 SEP 90

Objectives: To develop high yielding cultivars of *Limnanthes alba* and *L. douglasii* through hybridization and selection; to develop quantitative genetic information on ideotype related traits; and to develop, catalog and conserve genetic resources of *Limnanthes*.

Approach: Initiate selection for ideotypes in taxa based on high yielding ability and a series of studies aimed at developing elite germplasm resources. Hybridization between selected families will lead to new cycles of selection for recombinations of desirable features from different taxa. High yielding lines will be tested over several locations and years. Genetic resources will be conserved as well as distributed to the other researchers.

Progress: 84/01 to 84/12. The *L. alba* x *L. floccosa* hybrids were advanced into the backcross and F(2) generations which germinated poorly; however, based on a total of 30 plants in the segregating generations, autogamy from *L. floccosa* was only partially recovered as judged by floral morphology and seed set. More crosses were attempted using *L. floccosa* var. *californica* which provided more F(1) seed. Intraspecific hybrids in *L. douglasii* and *L. alba* are now being observed for segregation patterns in the F(2) generation. Several Mendelian loci for flower color, leaf pubescence and anther color appear to be available. A large number of inter-population hybrids were developed based on two years of agronomic evaluation of 15 populations. A yield trials at Davis gave estimates of seed yield as high as 1500 kg/ha for two *L. douglasii* accessions. Feasibility of small-plot yield trials provided a suitable field plot technique for initiating family selection. New breeding criteria were defined by the data on crop growth and resource allocation. Male sterility found in 2 populations of *L. douglasii* is being transferred to the other taxa.

Publications: 84/01 to 84/12

RITLAND, K. and JAIN, S.K. 1984. A comparative study of floral and electrophoretic variation of life history characters in *Limnanthes alba*. (*Limnanthaceae*). *Oecologia* 63:243-251.

KESSELI, R. and JAIN, S.K. 1984. New variation and biosystematic patterns detected by allozyme and morphological comparisons in *Limnanthes* section *Reflexae* (*Limnanthaceae*). *Plant Syst Evol* 147:133-165.

06.003 CRIS0082856
**DEVELOPMENT OF NEW CROP GENETIC RESOURCES AND
 OF CONSERVATION STRATEGIES**

JAIN S K; Agronomy & Range Science; University
 of California, Davis, **CALIFORNIA** 95616.
 Proj. No.: CA-D*-ARS-4059-H Project Type: HATCH
 Agency ID: CSRS Period: 01 JUN 85 to 30 SEP 90

Objectives: To develop optimal conservation
 strategies with the following specific studies:
 (1) maintenance of amaranth germplasm utilizing
 newly synthesized gene pools; (2) population
 genetic studies on seed samples under various
 storage regimes; (3) study of genetic variation
 in nature reserve populations of *Limnanthes*
spp.; (B) to continue agronomic and plant
 improvement work on grain amaranths and
 meadowfoam and to register improved genetic
 stocks for release to other users.

Approach: Evaluation of populations; selection
 of superior genotypes for use as parents in
 inter- and intraspecific hybridization and
 breeding work under controlled pollination and
 crop environments. Population genetic changes
 will be monitored using electrophoretic and
 morphological loci.

Progress: 84/01 to 84/12. 4059/SKJ/New
 collections of landraces in India and of
 crop-weed hybrids in the Stockton-Modesto delta
 area have been added to the continuing surveys
 of genetic resources in grain amaranths. Genes
 for male sterility, shattering, photoperiod
 response, and plant dwarfing have been located
 in different populations; quantitative genetic
 variation for various yield components
 including harvest index and seed set efficiency
 provided further descriptors in the catalog of
 amaranth germplasm. Based on these studies and
 three years of yield trials and reselection,
 the four most promising germplasm accessions
 will be prepared for registration and release
 in May 1985. A *Limnanthes* germplasm catalog is
 also being prepared in order to list the taxa,
 populations, characters and germplasm
 attributes we have analyzed during the past six
 years for both *Limnanthes* and *Amaranthus*,
 genetic conservation through seed storage as
 well as synthesis of composite gene pools has
 been systematically initiated. Allozyme surveys
 of stored seed samples are beginning to provide
 estimates of gene frequency shifts during
 storage.

Publications: 84/01 to 84/12

- JAIN, S.K. 1984. Biosystematic and
 evolutionary studies in *Limnanthes* spp.: An
 update. In: S.K. Jain and P. Moyle (Eds.)
 Vernal Pools and Intermittent streams in
 California, pp. 232-242. Institute of
 Ecology, UC Davis.
 HAUPTLI, H. and JAIN, S.K. 1984. Genetic
 variation in landrace populations of Indian
 amaranths. *Euphytica*. In press.
 JAIN, S.K. 1984. New crops as models of
 research on plant genetic resources.
 California Genetic Resources Workshop
 Proceedings, April, 1984. College of
 Agricultural and Environmental Sciences, UC
 Davis, (Abstract).

06.004* CRIS0044659
**INTRODUCTION, EVALUATION, AND PRESERVATION OF
 NEW CROP SPECIES--NORTH-CENTRAL-REGION**

CLARK R L; ROATH W W; Plant Introduction Res;
 Agricultural Research Service, Ames, **IOWA**
 50010.
 Proj. No.: 3808-20160-006-00D

Project Type: INHOUSE
 Agency ID: ARS Period: 17 JUL 78 to 30 MAR 85

Objectives: Through evaluation and research for
 adaptability and cultural requirements, gain new
 and improved knowledge of the chemical,
 biological, and agronomic potentials of
 selected industrial oils, waxes, gums, fibers,
 of food and feed proteins, and licit and
 illicit drugs and other medicinals, with
 emphasis on plants of current interest.
 Increase seed for distribution for use in
 experimental plantings and for preservation of
 germplasm collections.

Approach: Plant materials will be obtained
 through exploration and introduced for both
 chemical and cultural evaluation in the search
 for food, feed, and industrial end-uses which
 would be the basis for new or replacement crops
 for the United States. The work may involve
 cooperation between the Northern Regional
 Research Center, the State Experiment Stations,
 and other research institutions in the regions,
 both as to chemical and cultural problems.

Progress: 82/01 to 82/12. Techniques for
 increasing Brassica that would improve seed
 production and minimize outcrossing are being
 tested. Several accessions of *B. napus* were
 grown in cages in 1982 with encouraging results
 as to seed production. More work will be
 continued under cages in 1983. P.F. Knowles,
 U.C. Davis, contributed more than 1500
 accessions of Brassica to NC-7 over a period of
 years. In 1982 we sent 64 pounds of *Berteroa*
incana seed to the Northern Regional Research
 Center, Peoria, IL as part of the cooperative
 work with the Center.

Publications: 82/01 to 82/12
 NO PUBLICATIONS REPORTED THIS PERIOD.

06.005* CRIS0082026
INVESTIGATION OF NEW CROPS FOR NEVADA

GILBERT D E; JENSEN E H; LEEDY C D; Plant Soil
 & Water Science; University of Nevada, Reno,
NEVADA 89557.
 Proj. No.: NEV00486 Project Type: STATE
 Agency ID: SAES Period: 01 JUL 80 to 30 JUN 83

Objectives: Evaluation of plant species
 identified and suggested as potential new crops
 for Nevada, selection of most promising species
 for field testing and economic assessment and
 collection and evaluation of available
 information about these species.

Approach: Review literature and match crop
 requirements with climate and soil conditions
 based upon area analogs. Plant field trials no
 larger than 0.25 acre of selected crops and
 evaluate for production potential. Review

literature for exotic species from analogous areas and plant field trials no larger than 0.25 acre for evaluation. For those species which pass screening tests, initiate programs of seeding dates, rates, fertilizers, irrigation, weed control, harvesting and economic assessment.

Progress: 83/01 to 83/06. Plantings of gopher weed (*Euphorbia lathyris*) at Reno and Austin failed to survive through the first winter. In the milder climate at Fallon the plant survived but latex production was insufficient to hold much prospect for petroleum fuel substitution. Observations revealed that sufficient wild germplasm exists to indicate the plant can grow in areas of 130 day growing season; pathological activity of the wild seed source was excessive in that the plant is a prolific seed producer under the cool temperatures of desert night. Investigations with meadowfoam (*Limnathes alba*) and crambe (*Crambe abyssinica*) revealed that meadowfoam will not perform under our dry conditions. Crambe may produce if handled as a winter annual.

Publications: 83/01 to 83/06
NO PUBLICATIONS REPORTED THIS PERIOD.

06.006 CRIS0028743
CHEMISTRY AND METABOLISM OF FATTY ACIDS AND THEIR DERIVATIVES

TINSLEY I J; LOWRY R R; Agri Chemistry; Oregon State University, Corvallis, OREGON 97331.
Proj. No.: ORE00782 Project Type: STATE
Agency ID: SAES Period: 01 JUL 81 to 30 JUN 86

Objectives: Develop analytical and procedures for fatty acids and their derivatives; explore nutritional effects of individual fatty acids; study the toxicological effects of fatty acids and their derivatives; and co-operate with other investigators in the experiment station when appropriate in the development of new crops.

Approach: One phase of the program will be concerned with the development of analytical procedures for fatty acids and related complex lipids, providing adequate support for this project and other Experiment Station programs needing this input. The effect of dietary fat on cancer will be explored by attempting to isolate the contribution of and interactions among individual fatty acids. The interaction of dietary fatty acids with serum lipids will be evaluated as a possible mechanism by which tumorigenic activity is modified. Further studies of halogenated fatty acids are planned, focusing on natural distribution and a systematic analysis of the metabolism and toxicological effects of these compounds.

Progress: 84/01 to 84/12. Research on meadowfoam oil has continued and the fact sheet summarizing physical properties has been completed. In particular it shows that there are distinct advantages to dehulling the seed prior to oil extraction. In the oil, sulfur content is reduced by a factor of four and

color by a factor of two, while the protein content of the meal increased by 52% and the fiber reduced by 46% improving the nutritional quality meal substantially. Unfortunately, the glucosinolate/protein ratio was not affected. A new method for determining glucosinolate levels (a toxic constituent of meadowfoam meal) is being developed that would permit rapid screening and aid in selecting lines to propagate. Routine laboratory support for exploring markets for meadowfoam oil have continued including bleaching of the oil and preparation of the alcohols and waxes. Technical assistance and consultation has been provided to nine individuals outside of the department (six in the experiment station) with their studies of lipids and fatty acids. Over 118 hours were committed to these varied projects. Preliminary investigations of the fatty acids of *Cuphea* (primarily C 12 fatty acids) have been initiated in co-operation with other investigations attempting to develop a commercial crop from these species.

Publications: 84/01 to 84/12
NO PUBLICATIONS REPORTED THIS PERIOD.

06.007 CRIS0013887
THE INTRODUCTION, AGRONOMIC EVALUATION & IMPROVEMENT OF POTENTIAL NEW CROPS FOR OREGON

JOLLIFF G D; Agronomic Crop Science; Oregon State University, Corvallis, OREGON 97331.
Proj. No.: ORE00481 Project Type: HATCH
Agency ID: CSRS Period: 01 MAY 60 to 30 JUN 86

Objectives: Find, evaluate and develop new agronomic crops for Oregon.

Approach: Field, greenhouse and laboratory experiments will be conducted to accomplish the above objectives. Selected accessions screened by USDA will be evaluated for adaptation and agronomic features. Promising species will be studied for development of cultural practices, selection of superior plants, physiological characteristics and breeding to improve yields and product quality in accord with needs for commercial development.

Progress: 84/01 to 84/12. Low night temperatures during the growing season were found to severely limit seed yield of indeterminate field-grown soybeans. It appears that dry matter is partitioned to vegetative growth at the expense of seed yield. An initial effort was made to locate germplasm with tolerance to low night temperatures. It appears that tolerance is available in soybeans developing by Holmberg in Sweden. Interspecific hybridization of *Limnathes floccosa* ssp. *grandiflora* x *L. alba* ssp. *alba* was accomplished for the purpose of developing a self-pollinating *L. alba* plant type for agronomic production. This has led to the development of a population of hybrid materials; however, methods of progeny evaluation need to be developed. Agronomic studies were initiated with one selection of *Cuphea wrightii*.

Publications: 84/01 to 84/12

- JOLLIFF, G.D., CALHOUN, W. and CRANE, J.M. 1984. Development of a self-pollinated meadow-foam from interspecific hybridization. Crop Sci. 24:369-370.
- SEDDIGH, M. and JOLLIFF, G.D. 1984. Effects of night temperature on dry matter partitioning and seed growth of indeterminate field-grown soybean. Crop Sci. 24:704-710.
- SEDDIGH, M., and JOLLIFF, G.D. 1984. Night temperature effects on morphology, phenology, yield, and yield components of indeterminate field-grown soybean. Agron. J. 76:824-828.
- SEDDIGH, M. and JOLLIFF, G.D. 1984. Physiological responses of field-grown soybean leaves to increased reproductive load induced by elevated night temperatures. Crop Sci. 24:952-957.
- JOLLIFF, G.D., WHEELER, C. and CRANE, J.M. 1984. "Mermaid" meadowfoam (*Limnathes alba*) variety acceptance request. Oregon Agricultural Experiment Station. Corvallis, Oregon. 4 pp.

06.008 CRIS0025056
WEED CONTROL IN AGRONOMIC CROPS AND NON-CROP AREAS

APPLEBY A P; BREWSTER B D; Crop Science; Oregon State University, Corvallis, OREGON 97331.
Proj. No.: ORE00041 Project Type: STATE
Agency ID: SAES Period: 01 NOV 84 to 31 OCT 89

Objectives: Develop weed control measures for the state using chemical, mechanical, and cultural methods. Study factors which may influence weed control measures. Develop new methods of crop culture made possible by available weed control methods. Study the ecological interactions between crops and weeds. Develop methods for weed control on non-crop areas.

Approach: Field experiments will be established on research farms and grower fields to meet above objectives. Greenhouse, growth chamber, and laboratory studies will be conducted on factors influencing weed control practices.

Progress: 84/01 to 84/12. Racer fluorochloridone continued to look promising for grass and broadleaf control in winter wheat, possibly as a replacement for diuron. It is superior to diuron for control of speedwell and bedstraw and is approximately equal on most other weeds. Racer also shows promise for selective weed control in peppermint. SD 95481 (Cinch) has proven too phytotoxic to wheat but appears promising for established peppermint. Clopyralid (Dowco 290) is again being considered for registration by the manufacturer. It has been superior to dicamba for control of Composite family weeds in small grains. Preliminary results indicate that it may solve several serious problems in mint such as dandelion, salsify, groundsel, and other Composite weeds. After extensive screening for herbicides in meadowfoam, prospects look bright for control of grasses but bleak for selective

control of broadleaves. Significant progress was made in finding herbicides for selective weed control in pyrethrum. A wide range of selective grass killers performed safely and effectively. Bromoxynil showed only minor injury and controlled many broadleaves. Several other herbicides appear promising on transplanted pyrethrum. Further work is underway. Low rates of Goal + paraquat continued to perform well in dormant peppermint. This nonpersistent combination may allow the use of less residual herbicides in mint.

Publications: 84/01 to 84/12

- APPLEBY, A.P. 1984. Plant factors in examining fate of herbicides in soil. Abstr. Weed Sci. Soc. Am. p. 94.
- BREWSTER, B.D. and APPLEBY, A.P. 1984. Blackgrass control in winter wheat. West. Soc. Weed Sci. Res. Prog. Rep. p. 183.
- GEDDENS, R.M., APPLEBY, A.P. and BREWSTER, B.D. 1984. Non-herbicidal effects of dinoseb application date in early- and late-planted winter wheat. West. Soc. Weed Sci. Res. Prog. Rep. p. 203.
- GEDDENS, R.M., APPLEBY, A.P., and POWELSON, R.L. 1984. Effects of cereal herbicides on the incidence and severity of take-all disease of winter wheat. West. Soc. Weed Sci. Res. Prog. Rep. p. 209-210.
- GEDDENS, R.M., APPLEBY, A.P., and POWELSON, R.L. 1984. Effect of diclofop-methyl on the incidence and severity of take-all disease of winter wheat. West. Soc. Weed Sci. Res. Prog. Rep. p. 211-212.

06.009 CRIS0085959
FACTORS AFFECTING YIELD AND QUALITY OF SEED CROPS

GRABE D F; Crop Science; Oregon State University, Corvallis, OREGON 97331.
Proj. No.: ORE00431 Project Type: HATCH
Agency ID: CSRS Period: 13 NOV 81 to 30 SEP 86

Objectives: Develop improved techniques for evaluating seed quality components. Investigate new seed production practices for improved yield, quality and efficiency. Determine effects of seed quality components on crop production.

Approach: Develop varietal identification systems for wheat, ryegrass, and Kentucky bluegrass; develop oven-methods of moisture testing and evaluate existing moisture meters for grass seed; reduce seed germination test periods by incorporating recent advances in germination physiology. Determine the feasibility of establishing grass seed fields with cover crops; evaluate seed maturity indexes as guides to time of harvesting for maximum yield and quality. Study the basic factors governing seed size; determine the effects of seed size and source on crop stands and yields; determine the feasibility of hulling grass seeds for faster stand establishment.

Progress: 84/01 to 84/12. Studies were continued on establishment of red fescue seed crops with cereal companion crops. In plots established in Fall 1982, cereal companion crops did not significantly reduce the first red fescue seed crop harvested in 1984. Row spacing of the cereals had no effect on red fescue seed yields. Cereal competition did not reduce the amount of soil moisture or leaf area per grass tiller, but reduced the amount of light penetrating the canopy and number of vegetative tillers. Electrophoretic procedures were developed for distinguishing varieties and species of ryegrass. SDS-PAGE of seed proteins differentiated all but two pairs of the 28 perennial varieties studied. Individual varieties were characterized by presence or absence of specific protein bands and by band intensity ratios calculated from densitometer scans. The annual and intermediate varieties possessed two protein bands that were not found in any of the perennial varieties. Two bands were present in the perennial varieties that were absent or very faintly stained in the annual and intermediate varieties. Densitometer scans could detect the presence of a mixture of 10% or more annual seed in perennial seed. Studies were begun to characterize seed dormancy in meadowfoam. Germination occurred at 15 C or below but not at 20 C or above.

Publications: 84/01 to 84/12

SMITH, A.J. and GRABE, D.F. 1984.

Radiographic density measurements for determination of viability and vigor in corn (*Zea mays*) seeds. Seed Sci. and Technol. Accept of pub.

FERGUSON, J.M. 1984. SDA-PAGE of seed proteins for identification of varieties and species of ryegrass (*Lolium* spp.). M.S. Thesis, Oregon State University, Corvallis. 69 p.

COM 07 RAPESEED

07.001 CRIS0087707
RAPESEED (BRASSICA NAPUS L.) CULTURE FOR OIL
PRODUCTION

ODOM J W; PEDERSEN J; THURLOW D L; Agronomy &
Soils; Auburn University, Auburn, ALABAMA
36830.
Proj. No.: ALA00562 Project Type: HATCH
Agency ID: CSRS Period: 01 JUL 82 to 30 SEP 86

Objectives: To identify rapeseed-soybean
variety combinations acceptable for
double-croppingsystems. To determine the
optimum fertility levels for rapeseed double
cropped with soybeans. To determine appropriate
weed control practices for rapeseed rotations
with soybeans and the applicability of chemical
ripening agents for rapeseed harvest.

Approach: Each objective will be addressed with
a series of appropriate field experiments
located on outlying units of the Alabama
Agricultural Experiment Station.

Progress: 84/01 to 84/12. All rape
experiments, where the rape was being double
cropped with soybeans, winter killed during the
1983-1984 growing season. This is the second
such incident during this project. Because
Alabama is normally dry in the fall, it is
difficult to plant rape after soybeans early
enough to get good fall growth and thereby
avoid winter kill and also maximize rapeseed
yield. Single crop rape experiments, where
therape is planted early in the fall, have not
winter killed and have given consistantly
higher yields. Because of the winter kill
problem, rape, as a double crop, may be
restricted to growers having supplemental
irrigation. Yields of single crop rape in
Alabama are comparable with the yields reported
for the rape growing areas of Europe. All boron
fertilization experiments with rape have been
changed to include a spring as well as a fall
application of B as B fertilization has not
been detected as uptake in the rapeseed. At
this time it is not known if the applied B was
not taken up or if the B taken up was not
translocated to the rapeseed.

Publications: 84/01 to 84/12
NO PUBLICATIONS REPORTED THIS PERIOD.

07.002 CRIS0078707
IMPROVING RAPESEED PRODUCTION IN INTERIOR
ALASKA

KNIGHT C W; Agronomy; University of Alaska,
Fairbanks, ALASKA 99701.
Proj. No.: ALK-79-02 Project Type: HATCH
Agency ID: CSRS Period: 01 MAY 79 to 30 DEC 84

Objectives: Improve the production and quality
of rapeseed in Alaska through the selection of
better adapted varieties and improved cultural
practices. Improve the market quality of
rapeseed by developing better harvesting, seed
cleaning, and storage practices.

Approach: Rapeseed varieties will be screened
for adaptation to interior Alaska with special
emphasis being given to short-season varieties

from other northern areas. Cultural practices
such as plant populations, row widths, tillage
methods, fertilization rates, crop rotations,
and pesticide applications will be studied in
the field to evaluate their effects on
production. Harvesting procedures such as using
crop desiccants and swating will be evaluated
and compared to direct combining. Also, seed
cleaning and storage practices will be
evaluated to determine their effects on
rapeseed quality.

Progress: 84/01 to 84/12. Improving Rapeseed
Production in Interior Alaska. Two cultivars,
of spring rapeseed, Candle and Tobin, are each
planted at weekly intervals from mid September
until snow depth exceeds 6 inches. Weekly
plantings are resumed in the spring, as snow is
leaving the fields, and continued through the
first week in May. Plant population counts are
made during the seedling stage and maturity
notes are taken weekly throughout the growing
season. The results of two field seasons have
shown that plant populations from early spring
plantings greatly exceed plant populations from
autumn plantings. Seed yields from spring
planted plots have not differed greatly
regardless of planting date or cultivar.
Results thusfar have shown that seasonal
rainfall patterns have a much greater effect on
crop maturity than does date of planting. This
study is being continued with greater emphasis
on seed treatments and no-tillage seeding into
protective crop residues as means of improving
plant survival from autumn and early spring
plantings.

Publications: 84/01 to 84/12
NO PUBLICATIONS REPORTED THIS PERIOD.

07.003 CRIS0095785
DEVELOPMENTAL CONTROL OF GENE EXPRESSION DURING
RAPESEED GERMINATION AND EARLY SEEDLING GROWTH

HARADA J J; Agri Botany; University of
California, Davis, CALIFORNIA 95616.
Proj. No.: CA-D*-AB0-4522-H Project Type: HATCH
Agency ID: CSRS Period: 01 OCT 85 to 30 SEP 90

Objectives: Designing cogent approaches to crop
improvement using genetic engineering
procedures requires an understanding of the
cellular processes which regulate gene
expression during plant development. To gain
insight into these mechanisms, I propose to
identify specific DNA sequences involved in the
control of genes induced during rapeseed
germination and early seedling growth.

Approach: To isolate cloned mRNA sequences
specifically induced during germination and
early-seedling growth. These sequences will be
used to describe the developmental expression
of germination-induced genes.
Germination-induced genes will be isolated and
characterized. To localize developmental
control sequences, I will alter the gene's
structure in vitro, transfer the mutated gene
into plants, and examine the sequence
alteration's effect on the gene's developmental
expression.

07.004 CRIS0066538
GENETIC AND AGRONOMIC STUDIES OF OIL CROPS IN
NORTHERN CALIFORNIA

KNOWLES P F; Agronomy & Range Science;
University of California, Davis, CALIFORNIA
95616.

Proj. No.: CA-D*-ARS-3306-H Project Type: HATCH
Agency ID: CSRS Period: 23 SEP 74 to 31 DEC 83

Objectives: Objectives vary from crop to crop, depending on the activity of commercial plantbreeders, the scope of the USDA oilseed research program, and the stage of crop development. Objectives are: Development and evaluation of germplasm; Genetic studies of fatty acid and other characters; Cultural studies; Evaluation of oils as a diesel fuel substitute; Studies of relationships of the cultivated species to wild species (safflower and rapeseed); Studies of the reproductive process (sunflower); and, Studies of delayed leaf senescence (soybeans).

Approach: Introductions and selections evaluated for adaptation, for resistance to pests, and for quality. Genetic studies will be based on F(1), F(2) and F(3) generations. Cultural studies will be located at Davis and in adjacent counties. Crosses of species will be studied cytologically in F(1) and later generations. Studies of reproduction of sunflower will focus on factors reducing seed set.

Progress: 74/09 to 83/12. Brassica species were grown at UC Davis as rainfed winter crops. In 1977-78, 14,000 introductions were grown in single-row plots. In subsequent years, in addition to genetic nurseries, the most promising introductions or selections from introductions were advanced to 4-replicate yield tests. There were also Cooperative Extension trials in 5 counties. In all years Indian mustard, (B. carinata) were the most promising and highest yielding species. Selected Indian mustard entries were well adapted to California conditions. They had vigorous early growth, strong stems, were erect or only partially lodged at maturity and were resistant to shattering. Their period of lowering ended before significant aphid infestation occurred. Increased shatter resistance was associated with increasing seed size. Large yellow seeded, early maturing lines were developed from crosses of South Asian and European types. Oil content ranged from 34-40% and seed yields from 1400-3100 kg/ha. The two key quality traits in Bassica oilseeds are: Low erucic acid content in the oil and low glucosinolate content in the meal. Erucic acid free lines of B. juncea became available from Australia and glucosinolate free lines were identified at Davis. Well-adapted types of Indian mustard can now be produced which will be equal on seed meal and oil quality to the commercial cultivars of rapeseed and turnip rapeseed in Canada and Europe.

Publications: 74/09 to 83/12
NO PUBLICATIONS REPORTED THIS PERIOD.

07.005* CRIS0081673
DEVELOPMENT OF NEW AND IMPROVED CROPS FOR WATER
CONSERVATION IN ARID LANDS

RAINS D W; Agronomy & Range Science;
University of California, Davis, CALIFORNIA
95616.

Proj. No.: CA-D*-ARS-3983-RRProject Type: HATCH
Agency ID: CSRS Period: 01 OCT 79 to 30 SEP 86

Objectives: Evaluate species of Curciferace which will produce useful products under minimum water regimes and develop effective production practices for such species. Breed improved cultivars of guayule (Parthenium argentatum) having a high rubber content (15-20%) and develop economical cultural and harvesting procedures with emphasis on growing guayule under minimum water regimes.

Approach: Cruciferous species: Evaluate superior introductions of cruciferous species including Brassica campestris, B. napus, B. juncea, B. carinata, B. nigra, B. hirta, Crambe abyssinica and Eruca sativa for yield, seed oil content, fatty acid composition of the oil, other plant characters and resistance to pests. Conduct tests of fertilizers, herbicides and rates and dates of seeding. Initiate a breeding program to develop better adapted genotypes. Guayule: Test strains. herbicides, fertilizer treatments and irrigation treatments. Initiate a breeding program.

Progress: 84/01 to 84/12. Brassica species. Twenty one lines of B. juncea and B. carinata were released for distribution to breeders and geneticists. Disease free lines will be maintained by the Dept. of Plant Pathology, University of Wisconsin (Paul Williams). Four rep yields tests were planted at two sites in Yolo county; primarily of advanced lines of B. campestris but also including B. juncea and B. nigra. B. campestris lines will also be evaluated spring planted in Saskatoon. Lupinus species. Cooperative extension trials of sweet cultivars of L. albus were planted at 12 locations in seven counties; primarily for seed production but also for forage mix provided for cooperative research with Environmental Toxicology on alkaloid metabolism in dairy cows (Crosby) and one ton lots of 1985 harvested seeds will be given to Avian Sciences for poultry feeding studies (Vohra). Seed was provided for N(2) fixation and cultural practices studies at UC Davis (Cassman). Evaluation of lupine diseases at all locations will begin this Spring (Buddenhagen).

Publications: 84/01 to 84/12
COHEN, D.B. and KNOWLES, P.F. 1984. Release of Brassica germplasm from UC Davis. Crucifer Genetics Newsletter, Fall.

07.006* CRIS0048600
SHORT-RUN SUPPLY, DEMAND, AND PRICE ANALYSIS

COLLINS K; EVANS S; VAN MEIR L; Economic
Research Service, Washington, DISTRICT OF
COLUMBIA 20250.

Proj. No.: NED-SD&PA-4175 Project Type: INHOUSE
Agency ID: ERS Period: 01 OCT 82 to 30 SEP 83

Objectives: Analyze supply and use of major field crops by focusing on short-run price formation, quarterly feed-livestock relationships, and shifts in end-use demand.

Approach: Develop quantitative forecasting models that emphasize direct causality as contrasted to development of structural models. Focus on where there have been problems of forecast accuracy. Coordinate the model development to include livestock and relationships with variables pertaining to the macro economy.

Progress: 82/10 to 83/09. In-depth analyses of the factors underlying supply, use, and price formation of major field crops was conducted. The 1983 crop programs, especially the payment-in-kind (PIK) program prevented some planned analyses from being completed, such as estimation of feed-livestock relationships. However, a large volume of unplanned articles, staff assignments, and speeches related to policy and policy impacts were completed. These included analyses of farmers' net returns from program compliance, proposals for operating the PIK program, decision criteria for selecting whole base bids, alternatives for meeting PIK deficits, analyses of the 1984 farmer-owned reserve, and policy options for 1984 programs. In addition, special analyses on tobacco consumption trends and descriptions of the rapeseed and jojoba markets were completed.

Publications: 82/10 to 83/09

- EVANS, S. (1983). An economic analysis of the 1982 cotton acreage reduction program and implications for 1983. Proceedings, Beltwide Cotton Conference (January) 15pp.
- COLLINS, K. (1983). Cotton comparative advantage and policy in the 1980's. Proceedings, Beltwide Cotton Conference (January) 13 pp.
- CLAFFEY-STUCKER, B. (1983). Impact of the 1983 program on ending stocks by type, Rice Outlook and Situation, RS-41 (March) pp. 10-11.
- COLLINS, K. and SCHIENBEIN, A. (1983). analysis of the 1983 wheat program, Wheat Outlook and Situation, WS-263 (February) pp. 12-16.
- EVANS, R.S. (1983). An economic analysis of the 1983 upland cotton program, Cotton and Wool Outlook and Situation, CWS-34 (MARCH) pp. 15-17.

07.007 CRIS0049839
POTENTIAL FOR WINTER RAPE PRODUCTION & DEVELOPMENT OF ON-FARM OIL RECOVERY AND PROCESSING METHODS

BUTLER J L; Southern Ag Energy Center; Agricultural Research Service, Tifton, GEORGIA 31794.
Proj. No.: 6602-20195-016-99R

Project Type: INHOUSE
Agency ID: ARS Period: 15 OCT 84 to 30 SEP 87

Objectives: The potential of winter rape as an oilseed/diesel fuel substitute will be determined. Promising cultivars will be

selected/developed. Variables which lead to efficient small-scale oil extraction, using CO₂ or other extraction solvents will be identified. Agreement with Department of Energy.

Approach: Elite lines of winter rape with selected characteristics will be developed and tested at Moscow, ID and at selected locations in the east and south. Rape oil modifications and engine tests will also be conducted at Moscow, ID. Two cultivars of rape will be planted on three different planting dates at Tifton, GA to determine the optimum planting time. Peanuts will be grown in rotation of winter rape. At Athens, GA a small scale expelling/extractor procedure will be designed.

07.008 CRIS0049753
POTENTIAL FOR WINTER RAPE PRODUCTION IN THE COASTAL PLAIN

BUTLER J L; THREADGILL E D; Agricultural Engineering Research Division ARS USDA; Georgia Coastal Plain Expt Sta, Tifton, GEORGIA 31794.
Proj. No.: 6602-20195-018-99S

Project Type: COOPERATIVE AGREE.
Agency ID: ARS Period: 15 OCT 84 to 15 OCT 85

Objectives: To determine the potential of winter rape as an oilseed/diesel fuel substitute in the Coastal Plain, and to determine the potential of double-cropping winter rape/peanuts to produce maximum yields per acre while conserving soil.

Approach: Two cultivars of rape, Dwarf Essex and a Canola type will be planted on three different planting dates to determine the optimum planting time. Rainfall simulators will be used to determine the effectiveness of the rape cover in reducing soil erosion. Methods to harvest the crop, compatible with the climatic conditions will be developed. Winter rape has shown indications of reducing nematode and fungal populations in the soil. Peanuts will be grown in rotation of winter rape and the pesticide/yield relationship of this combination will be compared with that for conventional peanut production. Seed and oil yield will be evaluated for both crops.

07.009 CRIS0081652
ALTERNATIVE ENERGY SOURCES FOR AGRICULTURAL PRODUCTION

SMITH S M; PETERSON C L; Agri Economics; University of Idaho, Moscow, IDAHO 83843.
Proj. No.: IDA00787 Project Type: HATCH
Agency ID: CSRS Period: 01 JUL 80 to 30 JUN 86

Objectives: Determine and assess available technology for on-farm production of alternative energy and develop means to expand its use and production; develop new practical alternative energy systems for agricultural

use; and determine profitability of these systems alone, and within the context of the entire farm enterprise. Initial concentration will be on producing and using alcohol fuel from farm products.

Approach: Determine processes most suitable for on-farm use by small scale testing and observation of on-going operations. Monitor on-going operations and evaluate technological improvements to establish economic characteristics of existing and proposed alcohol plants. Examine a range of feedstocks, value of residue as animal feed, and the economics of scale for on-farm, small scale processes. Determine acreages of various crops needed to supply a typical farm's fuel needs, and the economic trade-offs of growing a crop for fuel versus growing as a cash crop. Partial budget, break even, and sensitivity analyses will test the effects of changes in key variables. Analyze and develop production processes to match labor requirements with amounts available on typical farms. Analyze and test alcohol produced in on-farm plants to determine fitness as fuel.

Progress: 83/01 to 83/12. The purposes of this project are to (1) examine alternative energy schemes for on-farm and/or small scale application, (2) propose new or improved systems to utilize the alternative energy sources, and (3) develop and distribute information about the technical and economic feasibility of the alternative energy systems. A comprehensive net energy study of on-farm vegetable oil fuel production was finished and published. The results show positive energy balances, which remain so even when a zero energy value of the meal co-product is assumed. A comparison of the profitability of on-farm production and use of vegetable oil fuel and ethanol was begun. Farm linear program models have been built and preliminary results obtained. Long term engine testing on two Yanmar TS-70C single cylinder engines compared the effect of shutdown on 100% diesel with the vegetable oil blend. A blend of 50% winter rape - 50% diesel was used as a fuel. The dual fueled engine operated 50% longer (3256 hrs. vs 2040 hrs.). Failure in both cases was due to a sudden increase in blow-by and loss of engine compression. The second set of engine tests utilized 6 Wisconsin engines to study the effect of vegetable oil fatty acid composition on engine deposits. Oleic and linoleic oils in a 50% blend with diesel were compared with straight diesel. Short-term performance tests demonstrate that the fuels are equivalent in developing engine power. Fuel economy and thermal efficiency are also similar.

Publications: 83/01 to 83/12

MCINTOSH, C.S., SMITH, S.M. and WITHERS, R.V.
1984. Energy balance of on-farm production and extraction of vegetable oil for fuel in the United States' Inland Northwest. Accepted for pub. in Energy in Agriculture.
MCINTOSH, C.S., SMITH, S.M. and WITHERS, R.V.
1983. Energy balance of on-farm vegetable oil production and extraction in selected areas of Idaho and Washington. Bulletin No. 129, College of Agriculture, University of Idaho.

MCINTOSH, C.S., SMITH, S.M. and WITHERS, R.V.
1983. Energy balance of on-farm vegetable oil production and extraction in selected areas of Idaho and Washington. In 3rd Annual Solar and Biomass Workshop.
WITHERS, R.V., SMITH, S.M. and MCINTOSH, C.S.
1983. Production of oilseed crops.

07.010

CRIS0088494

DETERIORATION OF VEGETABLE OILS BY OXIDATIVE AND THERMAL POLYMERIZATION

KORUS R A; Chemical Engineering; University of Idaho, Moscow, IDAHO 83843.
Proj. No.: IDA021095 Project Type: SPECIAL GRANT
Agency ID: CSRS Period: 15 SEP 82 to 30 SEP 85

Objectives: The problems of fuel deterioration during storage are more severe for vegetable oils than for commercial diesel fuels. The objectives of this research will be to measure fuel deterioration as functions of storage conditions, extraction methods, and vegetable oil composition. The storage deterioration results will be applied to the analysis of diesel engine performance where injector coking and carbon residue formation may result from vegetable oil polymerization.

Approach: Safflower, rapeseed, and sunflower oils will be studied. Rates of oxidative and thermal polymerization will be measured under storage conditions and at elevated temperatures. Diesel engine performance will be characterized by the rate of carbon residue accumulation of injector nozzles.

Progress: 82/09 to 83/12. The objective of this research is to characterize vegetable oil fuel deterioration as a function of storage conditions, extraction methods, and oil composition. Oil analysis has been completed after a six month storage period for safflower, rapeseed, and sunflower oils. Low peroxide values for samples stored as seeds indicate that there is little oxidative deterioration of oil in stored seeds. However, stored oils show significant levels of oxidative deterioration. Oxidation is especially significant for the linoleic safflower oil in aerobic storage. Oxidative deterioration is reduced with a more saturated oil and by anaerobic storage conditions. In an effort to correlate engine performance with polymerization measurements, the degree of carbon residue formation on injector tips was measured for 50% (v/v) mixtures of oils with D-2 diesel control fuel. To date four test cycles have been run, and the engine testing is approximately half complete. All vegetable oil fuels exhibited significantly greater deposits than pure diesel. Tests were run on a John Deere industrial diesel engine connected to an electric dynamometer and run at high loads to give rapid carbon coking. After each run injectors were removed and photographed. The difference in area was compared to a D-2 diesel injector silhouette. There was more carbon deposit with the 50% linoleic than the 50% winter rape mixture, but the oleic fuel was similar in extent of carbon residue formation to the rape mixture.

Publications: 82/09 to 83/12

- MOUSETIS, T.L. 1982. Oxidative and Thermal Polymerization of Vegetable Oils. M.S. Thesis. Univ. Idaho, Moscow. 152 p.
- KORUS, R.A., MOUSETIS, T.L. and LLOYD, L. 1982. Polymerization of Vegetable Oils. 1982 in Vegetable Oils as Fuels, American Society of Agricultural Engineers Publication 4-82.
- KORUS, R.A. and MOUSETIS, T.L. 1983. Polymerization of Safflower and Rapeseed Oils. JAACS in press.

07.011 CRIS0047909
POTENTIAL OF VEGETABLE OIL AS AN ALTERNATE SOURCE OF LIQUID FUEL FOR AGRICULTURE IN THE PACIFIC NW

BUTLER J L; PETERSON C L; AULD D L; College of Agriculture; University of Idaho, Moscow, IDAHO 83843.

Proj. No.: 6602-20195-006-05S

Project Type: COOPERATIVE AGREE.

Agency ID: ARS Period: 01 SEP 82 to 15 SEP 86

Objectives: To generate information on 1) the production of oilseeds as fuel crops; 2) smallscale systems for processing and storing oil and meal; and 3) the effective use of vegetable oils in diesel engines.

Approach: Develop new low glucosinolate varieties of rapeseed & determine the agronomic potential of these new cultivars along with sunflower & safflower as fuel oil crops. Develop and evaluate components for small-scale systems to expel, process and store oil and meal. This testing will include the feed- ing of the meal so that technical and economic studies may be made. Vegeta-ble oil will be used alone, with additives, & mixed in various proportions with diesel oil as a fuel for diesel engines. Sufficient data will be taken so that complete evaluation of the potential for these oils to sub- stitute for diesel can be made.

Progress: 82/07 to 82/12. Winter rape has the potential to produce twice as much farm-extractable oil (950 l/ha.) than either sunflower or safflower in most production areas of the PNW. Small scale expeller extraction removed 70, 75 and 85% of the oil contained in sunflower, safflower and winter rape, respectively. An expeller extraction facility capable of processing 40 kg. of seed per hour including 38,000 liters of storage could be constructed for less than \$30,000. Comparison of 40, 190, and 570 kg. of seed per hour sized processing facilities indicated that 570 kg./hr. would be the most cost efficient. Expeller extracted meals were shown to be acceptable protein supplements for both monogastric and ruminant animals. Rape seed meals high in glucosinolate did not make acceptable poultry feeds. Sixty-three F(3) families of winter rape were selected which have low levels of glucosinolate. Oxidative polymerization appears to limit the storage life while thermal polymerization is responsible for gum formation in long-term engine tests. The thermal polymerization

potential of various vegetable oils have been estimated using both laboratory procedures and short-term engine torque tests. In replicated 830-hour engine tests, a winter rape-diesel blend rich in erucic acid has had less engine wear, ring sticking and compression drop than a safflower oil rich in linoleic acid. Energy budgets indicate that safflower, sunflower, and winter rape produce 2.5, 2.6 and 4.2 megajoules of energy, respectively for each megajoule used in production and processing.

Publications: 82/07 to 82/12

- BETTIS, B.L., PETERSON, C.L., AULD, D.L., DRISCOLL, D.L. and PETERSON, E.D. 1982. Fuel characteristics of vegetable oils from oilseed crops in the Pacific Northwest. proc. of Int. Conf. on Plant and Vegetable Oils as Fuel. Fargo, ND.
- KORUS, R.A., MOUSETIS, T.L. and LLOYD, L. 1982. Polymerization of vegetable oils. Proc. of Int. Conf. on Plant and Vegetable Oils as Fuel. Fargo, ND.
- THOMAS, V.M., KATZ, R.J., AULD, D.L., PETERSON, C.L. and SAUTER, E.A. 1982. Expeller extracted rape and safflower oilseed meals for poultry and sheep. Proc. of Int. Conf. on Plant and Vegetable Oils as Fuel, Fargo, ND.
- THOMAS, V.M., KATZ, R.J., AULD, D.L., PETERSON and STEELE, E.E. 1982. Nutritional value of expeller extracted rape and safflower oilseed meals for poultry. Poultry Sci. (submitted July 1982).
- THOMPSON, J.D. and PETERSON, C.L. 1982. An automated small scale oilseed processing plant for production of diesel fuel engines. Proc. of Int. Conf. on Plant and Vegetable Oil as Fuel. Fargo, ND.

07.012* CRIS0072758
DEVELOPMENT OF ALTERNATIVE CROPS FOR NORTHERN IDAHO

AULD D L; MURRAY G; Plant & Soil Sciences; University of Idaho, Moscow, IDAHO 83843.
 Proj. No.: IDA00737 Project Type: HATCH
 Agency ID: CSRS Period: 01 JUL 77 to 30 JUN 84

Objectives: Determine the potential adaptation of several crop species to the climate and agricultural requirements of northern Idaho. Develop pest management and cultural practices as well as locate high yielding varieties of crops adapted tonorthern Idaho. In cooperation with commodity commissions and the Department of Agricultural Economics, locate and determine marketing potential for adaptedcrops while evaluating the economic feasibility of producing these crops in northern Idaho.

Approach: Alternate crop species will be screened for adaptation in replicated trials conducted at several locations in northern Idaho. Those crops with demonstrated potential for production will be subjected to variety testing and evaluation for weed control, insect control, soil fertility, and crop management practices. Proposed research will attempt to develop a total crop management program for each crop. Simultaneous cooperative projects with commodity commissions and agricultural

economists will attempt to locate and develop both domestic and export markets. The production costs of these crops will be estimated and compared with existing crops to determine the economic competitiveness of alternate crop production.

Progress: 83/01 to 83/12. Five plants from 202 selected F(4) families of winter rape were selected for low levels of glucosinolate. Selection gains for increased oleic acid (18:1) were 94.6 and 61.7% in two crosses. Selection gain for increased erucic acid (22:1) was 131.1% in the 'Norde' X 'Indore' cross compared to only 67.2 and 79.0% when Indore was crossed to WW827 and Sipal, respectively. Selection for an improved fuel value index was not successful. Five breeding lines and three cultivars of Crambe produced from 1810 to 2500 kg/ha of seed. None of the entries differed in seed yield, glucosinolate content, or fatty acid composition. The buckwheat cultivars 'Mancan,' 'Manor,' and 'Royal' produced 1900, 1900, and 2130 kg/ha of seed, respectively. Planting these cultivars on May 17, May 27, and June 6 produced 2090, 1770, and 1320 kg of seed per acre, respectively. The buckwheat cultivars did not respond to nitrogen fertilization. Two lines of chickpeas were released by the Foundation Seed Stocks Committee. 'Lyons,' a small seeded Kabuli type is a local landrace while '85-21' is a small dark brown desi introduced from India as a breeding line. Desi chickpeas 85-21 and C-235 averaged 1920, 1744, and 1778 kg ha on 8.8, 17.5, and 30 cm row spacings, respectively, at Moscow. Seed yield increased from 1279 to 2280 kg ha as population within a row increased from 6.6 to 19.8 seed m. Similar results were obtained at Grangeville.

Publications: 83/01 to 83/12

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- PETERSON, C.L., AULD, D.L. and THOMPSON, J.C. 1983. Experiments with vegetable oil expression. Trans. ASAE 26:1298-1302.
- AULD, D.L., ULLRICH, S.E. and BETTIS, B.L. 1983. Screening safflower for winterhardiness in the Palouse region of eastern Washington and northern Idaho. Idaho Agr. Expt. Sta. Prog. Rept. 225.

07.013 CRIS0094740
DEVELOPMENT OF CULTIVARS OF WINTER RAPE
(BRASSICA NAPUS)

AULD D L; Plant Soil & Entomological Sci; University of Idaho, Moscow, IDAHO 83843.
Proj. No.: IDA00852 Project Type: HATCH
Agency ID: CSRS Period: 19 NOV 84 to 30 SEP 89

Objectives: Develop improved cultivars of winter rape with new high oil contents that have low levels of erucic acid (22:1) and low

levels of oleic acid (18:1) and linoleic acid (18:2) for use as edible oil. Cultivars will also have less than 30 mu moles/g of glucosinolate as well as good agronomic potential.

Approach: Both conventional breeding technology and anther culture will be used to advance inbred generations as rapidly as possible F(3) and F(4) generations will be screened for oil composition and glucosinolate concentrations. In the F(4) and F(5) generations measurements will be made on oil content and seed yield.

07.014* CRIS0044718
ISOLATION AND IDENTIFICATION OF ALLELOCHEMICALS
FROM UNCULTIVATED PLANTS

KLEIMAN R; SPENCER G F; WOLF R B; Northern Regional Res Center, Peoria, ILLINOIS 61604.
Proj. No.: 3620-20160-009-00D

Project Type: INHOUSE
Agency ID: ARS Period: 02 OCT 78 to 16 APR 87

Objectives: Detection and identification of phytochemical agents potentially useful in weed control and plant growth regulation.

Approach: Screen for useful biological activity such as bioregulation in extracts from seed and other plant parts. Activity will be measured by relative germination rates of selected weed seeds. Active principles will be isolated and characterized by chromatographic and spectroscopic means.

Progress: 83/01 to 83/12. The biological screening of extracts from seed of 225 wild species revealed germination inhibitors in 21 of them. Selections from this group will be made for isolation and characterization of active compounds. Benzyl isothiocyanate, an active germination inhibitor of velvetleaf seed at the 4×10^{-5} M level did not affect corn even at moderately high concentrations such as 10^{-4} M but did affect soybean at the 10^{-5} level. Soybeans were not affected at the 4×10^{-5} M level. The acetone extract of defatted Iva axillaris seeds was found to contain germination inhibitors tomentosin and ilicic acid. Other compounds, such as avivalin, had growth inhibitory properties. This work also resulted in the isolation a new sesquiterpene, tentatively identified as the isovalerate ester of ivaxillarin. Computer programs were written and data entered in order to have searchable files for future reference of germination inhibition data. In cooperation with plant breeders working in the new crop area, analyses for oil, protein, and fatty acids of seed were accomplished. Species included in this program were rape, crambe, Sapium, Sebiferum, Cuphea, and Vernonia.

Publications: 83/01 to 83/12
ABBOTT, T.P., JAMES, C., and PLATTNER, R.D. 1983. Products of wheat straw biodegradation by Cyathus stercoreus. ACS Symp. Ser. No. 214, Unconventional Sources of Dietary fiber, I. Furda, ed., Chap. 19,

pp. 267-284.

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- CARLSON, K.D., CUNNINGHAM, R.L., and HERMAN, I.A. 1983. Sweet sorghum grown on sludge-amended stripmine soil: A preliminary look at yields, composition, and ethanol production. Trans. Ill. State Acad. Sci. 76:111-122.
- CULL, I.M. 1983. Midwest plants for potential crops. Trans. Ill. State Acad. Sci. 76:213-216.
- GARCIA, W.J., CAVINS, J.F., INGLETT, G.E., HEAGLE, A.S., and KWOLEK, W.F. 1983. Quality of corn grain from plants exposed to chronic levels of ozone. Cereal Chem. 60(5):388-391.

07.015* CRIS0044659
**INTRODUCTION, EVALUATION, AND PRESERVATION OF
 NEW CROP SPECIES--NORTH-CENTRAL-REGION**

CLARK R L; ROATH W W; Plant Introduction Res; Agricultural Research Service, Ames, IOWA 50010.
 Proj. No.: 3808-20160-006-00D
 Project Type: INHOUSE
 Agency ID: ARS Period: 17 JUL 78 to 30 MAR 85

Objectives: Through evaluation and research for adaptability and cultural requirements, gain new and improved knowledge of the chemical, biological, and agronomic potentials of selected industrial oils, waxes, gums, fibers, of food and feed proteins, and licit and illicit drugs and other medicinals, with emphasis on plants of current interest. Increase seed for distribution for use in experimental plantings and for preservation of germplasm collections.

Approach: Plant materials will be obtained through exploration and introduced for both chemical and cultural evaluation in the search for food, feed, and industrial end-uses which would be the basis for new or replacement crops for the United States. The work may involve cooperation between the Northern Regional Research Center, the State Experiment Stations, and other research institutions in the regions, both as to chemical and cultural problems.

Progress: 82/01 to 82/12. Techniques for increasing Brassica that would improve seed production and minimize outcrossing are being tested. Several accessions of B. napus were grown in cages in 1982 with encouraging results as to seed production. More work will be continued under cages in 1983. P.F. Knowles, U.C. Davis, contributed more than 1500 accessions of Brassica to NC-7 over a period of years. In 1982 we sent 64 pounds of Berteroa incana seed to the Northern Regional Research Center, Peoria, IL as part of the cooperative work with the Center.

Publications: 82/01 to 82/12
 NO PUBLICATIONS REPORTED THIS PERIOD.

07.016 CRIS0093244
ALTERNATIVE CROPS FOR IOWA AGRICULTURE

HANSEN W R; Agronomy; Iowa State University, Ames, IOWA 50011.
 Proj. No.: IOW02685 Project Type: STATE
 Agency ID: SAES Period: 01 JUL 84 to 31 DEC 87

Objectives: Identify crops, other than corn and soybeans, which have potential to be grown in Iowa as sole-crops or in multiple cropping schemes to provide more diversity for Iowa agriculture and reduce the erosion from lands associated with the production of corn and soybeans. Identify the management and production inputs needed to maximize the production efficiency of these crops.

Approach: Investigate the following production and management inputs for small grains: row widths, growth regulator, and multiple nitrogen applications. Small grains to be investigated are: barley, hard red winter wheat, hard red spring wheat, oats, and soft red winter wheat. Establish initial plantings of selected plant materials (e.g. pulse and oilseed crops) at one location to further determine adaptability and agronomic potential. Expand locations and/or investigate cultural practices for efficient production following the identification of promising plant materials.

Progress: 84/07 to 84/12. Four varieties of winter rapeseed (high erucic acid) were planted at the Grundy-Shelby Research Center (Beaconsfield) on four dates (Aug. 8, 23, Sept. 5, and 19) to evaluate winter survival in Iowa and determine if there are winter survival-planting date-variety interactions. Soil moisture and rainfall were limited at Beaconsfield until mid-October; consequently, the rapeseed stands are fair to very poor. Hard red and soft red winter wheats were planted at the Agronomy-Agriculture Engineering Research Center (Ames) on October 2 for the row width-growth regulator-multiple nitrogen application study. Six varieties of hard red and six varieties of soft red winter wheat were planted at Ames on October 2 for the variety-growth regulator study. Hard and soft red winter wheats and winter barleys were planted at Beaconsfield for the same studies on October 10. Spring oats for these studies will be planted at Beaconsfield, Ames, and the Clarion-Webster Research Center (Kanawha). Spring barley and spring wheat will be planted at Ames and Kanawha. Spring rapeseed (high and low erucic acid) and pulse crops (white lupine and fieldpea) will be planted at Kanawha to evaluate their characteristics under northern Iowa growing conditions.

Publications: 84/07 to 84/12
 NO PUBLICATIONS REPORTED THIS PERIOD.

07.017 CRIS0091011
**WORLD OILSEED AND PRODUCT MARKETS: ECONOMIC
 STRUCTURE, INTERRELATIONSHIPS AND POLICY
 INTERVENTION**

WILLIAMS G W; Economics; Iowa State
 University, Ames, IOWA 50011.
 Proj. No.: IOW02650 Project Type: HATCH
 Agency ID: CSRS Period: 01 SEP 83 to 30 SEP 88

Objectives: Develop family of econometric simulation models of world markets for seven major oilseeds and their products (soybeans, cottonseed, peanuts, rapeseed, sunflower seed, copra and palm kernels) in eight world regions (U.S., Brazil, Canada, EC, Japan, other Asia and rest-of-world) linked by prices, policy interventions and trade flows; Develop the supporting data base; Test performance of the model; Use the model to make statements about the impact on the U.S. and world soybean markets of policies and events in the world oilseeds market.

Approach: Develop data base from USDA and individual country sources; Develop world soybean model as central component of overall model; Develop separate world models for the other oilseeds one at a time in about the order listed above; Validate the world models for each oilseed independently through simulation analysis; Link all models into full world model and validate as above; Utilize model to address issues relevant to U.S. and Iowa soybean industries.

Progress: 84/01 to 84/12. Completed work on a detailed, comprehensive world oilseed data base that includes supply and utilization, trade, and price data for seven major oilseeds and their products (soybeans, cottonseed, peanuts, rapeseed, sunflowerseed, copra, and palm kernels) in eight world regions (the U.S., Brazil, Canada, EC, Japan, other Asia and rest-of-the-world). Developed conceptual model of world oilseed markets for use in empirical estimation of relationships in the markets. Began development of a family of econometric simulation models of the world markets for the oilseeds and world regions contained in the data base.

Publications: 84/01 to 84/12

WILLIAMS, G.W. and THOMPSON, R.L. "The South American Soybean Industry: Its Growth and Future Prospects," Quarterly Journal of International Agriculture, 23(3): 264-280, July-September 1984.

WILLIAMS, G.W., "Development and Future Direction of the World Soybean Market," Quarterly Journal of International Agriculture, 23(4): October-December 1984 (in press).

WILLIAMS, G.W., and THOMPSON, R.L., "South American Soybean Industry: Policy Impacts and Issues," World Soybean Research Conference III: Proceedings, Boulder, CO: Westview Press, June 1985 (in press).

WILLIAMS, G.W., "Importer and Exporter Processing and the Bean-Product Trade Mix," World Soybean Research Conference III: Proceedings, Boulder, CO: Westview Press, June 1985 (in press).

07.018 CRIS0085103
**ENERGY AND ECONOMIC BENEFITS OF VEGETABLE OILS
 AS FUEL EXTENDERS**

FARSAIE A; LESSLEY B V; WIEBOLD W J; Agri
 Engineering; University of Maryland, College
 Park, MARYLAND 20742.
 Proj. No.: MD-RABC-067 Project Type: STATE
 Agency ID: SAES Period: 01 OCT 81 to 30 SEP 84

Objectives: Determine the total energy budget for the production, processing and utilization of peanuts, soybeans, rapeseed and sunflowers using single and double cropping system. Determine the net economic budget for the production, processing and utilization of the oil crops for diesel fuel extenders.

Approach: During the first year of the project, a literature search would be conducted to tabulate all energy and economic input-output data needed for the analysis. Also, field plot research and laboratory experiments on extraction and engine utilization of vegetable oils will be conducted. During the second year, the energy and economic models will be refined as needed based on the results of the field plots and laboratory studies. Feeding trials on the utilization of the oil crop by-products will be conducted with sheep and swine. Also, field plots of cropping systems which optimize oil production will be continued, low cost extraction process will be developed and longer-term engine studies will be conducted.

Progress: 81/09 to 84/09. On-farm oil production and extraction were evaluated for four oilseed crops produced in full-season or double cropping systems. Economic feasibility was determined by calculating the per-liter cost of vegetable oil based on total costs of production and processing as well as credits for feeding values of the oilseed residues. Variables included farm size (80, 240 or 400 ha), tillage method (conventional, reduced, or no-till), and percent vegetable oil in fuel mix (25 or 50%). Per-liter costs ranged from a high of \$7.01 for soybean oil from the 80-hectare, no-till wheat-soybean double-crop, 25% substitution rate, processing labor included, to a low \$0.58 for the 400-hectare, reduced tillage wheat-soybean double crop, 50% substitution rate, when processing labor was not included. Energy inputs and outputs were analyzed for winter rape, soybean, sunflower, and peanut oils. All four oilseeds yielded a positive energy balance (output greater than input). The energy output-to-input ratio ranged from 2.77 for conventional tillage sunflowers to 9.60 for no-till soybeans. The potential for greatest oil yields would be from double-cropping systems using winter rape and soybeans or sunflowers. Since the fall-planted winter rape matures early in the summer, double-cropped soybeans and sunflowers can be planted earlier than when these crops follow wheat.

Publications: 81/09 to 84/09
 NO PUBLICATIONS REPORTED THIS PERIOD.

07.019 CRIS0094317
VEGETABLE OIL AS AN ALTERNATIVE FUEL FOR DIESEL ENGINES

EIDMAN V R; Agri & Applied Economics;
 University of Minnesota, St Paul, MINNESOTA
 55108.

Proj. No.: MIN-14-093 Project Type: HATCH
 Agency ID: CSRS Period: 01 MAR 84 to 30 SEP 88

Objectives: To estimate the economic effects and the energy balance associated with the production and processing of vegetable oils for fuel.

Approach: Minnesota will expand the interregional competition model to include consideration of peanut oil, rapeseed oil, small scale vegetable oil, processing facilities, and ethanol production from grain. The impact of subsidies designed to retire land and support farm incomes at specified levels will be evaluated. The impact of subsidizing vegetable oil and/or alcohol production for fuel as alternative means of controlling agricultural supplies and supporting commodity prices will be analyzed. The research will compare program benefits (higher farm income, increased fuel availability, and greater energy self dependence) with program costs (administrative costs, program outlays, higher consumer prices, and environmental effects). Systems analysis will be used to analyze the effect of producing vegetable oils for fuel on the profitability, fuel self-sufficiency and management problems of representative farms for the policy alternative analyzed.

Progress: 84/01 to 84/12. The work under this project has emphasized model development and preparation of input data during the past year. A price-endogenous spatial equilibrium model is being developed to explore the aggregate economic effects on the agricultural sector from the production of vegetable oils for fuel. The model is designed to estimate the effects of diverting vegetable oil to fuel use on the production and prices of major U.S. crop and livestock commodities. The model is being solved with Stanford University's Modular In-Core Nonlinear Optimization System (MINOS), a nonlinear/linear programming solver. A matrix generator and a report writer have been written this year. Both of these programs have been tested and documented to insure that they function properly. Transportation costs of agricultural products via rail, barge and truck were developed previously (1983). Crop production and cost data have been assembled and formatted this year. Plans for 1985 include completion of the data preparation and validation of the model. Livestock production and cost data will be assembled in early 1985. Then regional demand relationships will be estimated and included in the model. These two components will complete the data preparation and the emphasis will shift to model validation.

Publications: 84/01 to 84/12
 NO PUBLICATIONS REPORTED THIS PERIOD.

07.020* CRIS0030039
ADAPTATION AND CULTURAL PRACTICES FOR NONTRADITIONAL CROPS WITH POTENTIAL FOR THE HIGH PLAINS OF MEXICO

FINKNER R E; Agri Science Center At Clovis;
 New Mexico State University, Las Cruces, NEW
 MEXICO 88003.

Proj. No.: NM-1-3-42143 Project Type: STATE
 Agency ID: SAES Period: 01 JAN 85 to 30 JUN 89

Objectives: Determine high yielding, well adapted cultivars of several nontraditional crops, i.e., soybeans, sunflowers, onions for seed, crambe, rapeseed, Jerusalem artichokes, guayule, grapes, chick-peas, pearl millet, buffalo gourds, and other minor crops which may have potential value for the High Plains area of New Mexico. Study the effects of varying cultural practices on yield and quality of the species and cultivars under study. Investigate problems which develop, relating to the adaptation and production of nontraditional crops.

Approach: Replicated field tests and lab analyses will be used to determine the highest yielding and the best quality cultivars and the most productive cultural practices.

Progress: 84/01 to 84/12. Field tests were conducted on various crops for yield and quality. Thirty grain corn hybrids produced an average yield of 10,111 kg/ha. The average yield of ten forage corn hybrids was 8.02 T/ha of dry matter. Sixteen soybean cultivars had an average grain yield of 2940 kg/ha. Ten sunflower hybrids were yield tested under dryland and full irrigated conditions. Dryland yields averaged 2191 kg/ha with a 45.2 percent oil. The dryland test was furrow diked and a total of 41.35 cm of moisture fell with no runoff. Yield of the irrigated hybrids only averaged 1544 kg/ha with a 44.9 percent oil. The test was irrigated twice. This year, furrow diking was more effective than irrigating in producing high yields.

Publications: 84/01 to 84/12
 FINKNER, R.E. April 1984. Soybean variety trials on the High Plains of eastern New Mexico, 1978 through 1983. NMSU Agri. Exp. Sta. Res. Rep. 536.
 FINKNER, R.E. May 1984. Response of pinto bean varieties to date of planting on the eastern High Plains. NMSU Agri. Exp. Sta. Res. Rep. 541.

07.021* CRIS0093647
ALTERNATE ENERGY PRODUCTION FOR THE EAST CENTRAL PLAINS

MORIN G; FINKNER R E; Agriculture Science
 Center; New Mexico State University, Las
 Cruces, NEW MEXICO 88003.

Proj. No.: NM-1-3-42416 Project Type: STATE
 Agency ID: SAES Period: 01 JUL 83 to 30 JUN 88

Objectives: Compare potential nontraditional fuel alcohol feedstocks for the east central plains with traditional feedstocks (grass). Compare nontraditional vegetable oil feedstocks

for the east central plains with traditional feedstocks (sunflowers and soybeans). Evaluate the feasibility of non-farm production of electricity from wind for east central plains.

Approach: Field trials growing Jerusalem artichokes, sweet sorghum, buffalo goards will be compared to wheat and corn trials. Harvested produce will be processed through the pilot alcohol plant. Field trials growing buffalo goards under fertilizer and water treatments will be compared to traditional oil crops management. Data from wind design will be collected and economic of operations evaluated.

Progress: 84/01 to 84/12. Several different feedstocks were tried in the ethanol fuel alcohol pilot plant including wheat, grain sorghum, tobacco and micronized grain sorghum. Different grind sizes were tested and, in general, the finer the particle size, the greater the alcohol yield. The pilot plant was remodeled and a stripper column was added. Investigations continued on precook processing of fleshy material, i.e., potatoes, sugar beet roots, buffalo gourd roots, and Jerusalem artichokes. Crambe and rapeseed, potential fuel oil crops, were yield tested. Three different seeding rates (2.2, 2.5 and 2.7 kg/ha) of crambe were tested under irrigated and dryland conditions. No significant differences (5% level) were detected among the seeding rates. Average irrigated yield was 1159 kg/ha dryland was 1033 kg/ha. The average oil content was 21.3 percent. Two different rapeseed cultivars (regent and Tower) were tested under dryland and irrigated conditions. No significant yield differences (5%) were detected between the two cultivars. The dryland test, with 321 mm of rainfall, yielded more than the irrigated test (1567 kg/ha vs 1156 kg/ha). Oil content of the rapeseed averaged 37.6 percent. Dryland test areas were furrow diked so no runoff occurred. Eleven cultivars of Jerusalem artichokes were yield tested under dryland and irrigated conditions. Average dryland yield was 26 T/ha with a 21.9 percent Brix. Average of the irrigated tests was 40 T/ha with a 19.5 percent Brix.

Publications: 84/01 to 84/12

NO PUBLICATIONS REPORTED THIS PERIOD.

07.022* CRIS0092535
**INTRODUCTION AND EVALUATION OF POTENTIAL
 ALTERNATIVE CROPS FOR NEW MEXICO AGRICULTURE**

LESSMAN K J; Crop & Soil Sciences; New Mexico State University, Las Cruces, **NEW MEXICO** 88003.

Proj. No.: NM-1-5-27432 Project Type: HATCH
 Agency ID: CSRS Period: 01 MAR 84 to 30 SEP 88

Objectives: To introduce potential new field crops which will produce useful products particularly for industrial applications; To evaluate the breeding potential of introduced new crop species; To breed for improved cultivars of introduced species after evaluation of breeding potential and determine the feasibility of Crambe spp. x Brassica spp. crosses.

Approach: Initial field and laboratory evaluations of Brassica spp., Crambe spp., Lesquerella spp., Amaranthus spp., Chenopodium spp., and Salsola spp. will be conducted over a three-year period. Characters studied for all materials will be seed germination, oil content, and glucosinolate content of seed meal will be studied for the Cruciferae spp. Heritability of all characters will be determined and expected gains from selection computed. Herbicides will be applied.

Progress: 84/01 to 84/12. Field evaluations of Crambe abyssinica, Brassica spp. (rape) Amaranthus sps. and Curcubita sp. (Buffalo gourd) were initiated during 1984. A replicated test nursery containing 100 crambe selections was seeded February 15. Data are being obtained for stand, seedling vigor, bloom time, height, yield, and oil production. Herbicides were applied to the crambe cultivar Meyer. The nursery area was essentially weed free and no damage was noted after dacthal (11.2 kgs/ha), treflan, and surflan (.5 kg/ha) were applied. The observation nursery containing amaranthus sps. showed shape considerable variation for inflorescence size shape color and grain yield. Selections for testing in 1985 were made. Of the eight Brassica lines evaluated, only four produced seed. Two populations 225,000 and 450,000 plants/ha of Buffalo gourd were seeded May 15 using two fertility levels in a split plot design with levels of fertility as the whole plot having five replicates. Data for gourd-seed and root-production will be obtained. Seeds and oil-free meal of Crambe abyssinica, seeds and ground seed of Sinapsis alba, seeds of Brassica juncea and seeds of Brassica napus were subjected to gamma irradiation (6.25, 12.5, 25.0 and 50.4 Mrad) to explore using irradiation to inactivate thioglucosidase and/or glucosinolate destruction. Exposure of 50.4 Mrad does inactivate thioglucosidase but has little affect on glucosinolates.

Publications: 84/01 to 84/12

KNOWLES, P.F. and LESSMAN, K.J. 1984.

Development of new crops. CAST Rpt. 102.

LESSMAN, K.J. and MCCASLIN, B. 1984.

Feasibility of using gamma irradiation to inactivate thioglucosidase from Cruciferae. Los Alamos Biotech. Conference. Oct. 15.

07.023 CRIS0068576
MISCELLANEOUS, OIL, AND SPECIALTY CROPS TESTING

LUKACH J R; HANSON B K; Langdon Agric Expt Station, Langdon, **NORTH DAKOTA** 58249.

Proj. No.: ND06302 Project Type: STATE
 Agency ID: SAES Period: 01 JUL 75 to 30 SEP 85

Objectives: Evaluate general adaptation and production potential of several specialty crops when grown in this environment, and to evaluate them as possible cropping alternatives for more intensive crop production in this geographical area.

Approach: Grow in specially designed and controlled experiments several specialty crops including sunflowers, corn, field beans (pinto

and navy), mustard, and soybeans in order to determine production potential and identify specific production problems such as disease reactions that may limit their place in crop rotations. Procedure is to use existing varieties and hybrids and test new selections for maximum production potential when growing in this environment. Major emphasis is to be placed on finding materials of early maturity and high yield so as to allow maturity in relatively short growing season that exists.

Progress: 84/01 to 84/12. Variety trials of several oil and specialty crops were tested to evaluate them for adaptation to northeast North Dakota. The trials were grown on Svea-Hamerly loam soil with fertility adequate for a 4747 kg/ha grain corn yield. Yields of late maturing crops were reduced due to hot dry weather in August and September. The mean yields for the variety trial of each crop in kg/ha are as follows: Oil Sunflowers 1448, Confectionary Sunflowers 1729, Grain Corn 3298, Silage Corn 93,697 at 70% H(2)O, Pinto Beans 1534, Navy Beans 1235, Specialty Dry Beans 1379, Soybeans 1318, Buckwheat 1242, Canary Seed 1280, Field Peas 1818, Lentils 2318, Yellow Mustard 1501, Oriental Mustard 1774, Brown Mustard 1688, Polish Rape 1491, Argentine Rape 1513, Garbanzo Beans 3187, Faba Beans 2074, Safflower 1392, Triticale 2829, Grain Sorghum 1831. A Buckwheat date and rate of planting trial was established for the varieties Manor, Mancan, and Tokyo. Planting rates for Tokyo, planting dates and rates for Mancan and Manor, and date x rate interactions were non-significant for yield. Tokyo had a significant yield increase with earlier planting. Soybean trials were established at six locations in northeast North Dakota to evaluate row spacing, seeding rate and inoculation. Thirty cm. row spacing averaged 241 kg/ha more yield than 60 cm. row spacing but the yield increase was significant at only two locations. Seeding rates of 371 and 556,000 plants per hectare had no significant differences in yield.

Publications: 84/01 to 84/12

LUKACH, J.R., HANSON, B.K. and STAFF. 1984
Farmers Report, Langdon Experiment Station,
North Dakota State University.

07.024* CRIS0067834 MISCELLANEOUS, OIL AND SPECIALTY CROPS

HOAG B K; THOMPSON C R; Minot N Central Agr Exp
Station, Minot, NORTH DAKOTA 58701.
Proj. No.: ND06347 Project Type: STATE
Agency ID: SAES Period: 01 JUL 75 to 30 SEP 85

Objectives: Determine production and adaptability of new oil and other specialty crops in north central North Dakota.

Approach: The station will evaluate and compare oil crops and other specialty crops with small research plots. Data will be collected and reported on yield, test weight, adaptability, plant height, oil content, and other necessary measurements.

Progress: 84/01 to 84/12. Thirteen safflower varieties were planted at Minot, May 21 and three at off station sites at Rugby and Rolette on May 14. The soil types were Williams loam, Gardena silty loam and Tonka with hamerly loam. The average yield and (top variety) at Minot were 2370 (S-541--2779); at Rugby 3463 (S-208--2619) and Rolette 2737 (S-208-2909) kg/ha. Seven rape varieties were planted May 21 on recrop at Minot, ND. The average yield of type and (Variety) are given in kg/ha. Argentine - 990 (Westar--1126); Polish - 1004 (Tobin--1133). Sixteen mustard varieties were planted May 21 on recrop at Minot, ND. The average yield of type and (variety) are given in kg/ha. Yellow - 1004 (Tileny--1090); Brown - 1484 (BU 1380-1454--1691); Oriental - 1657 (BU08-1418--1918). Oil type sunflower trial at Minot, Stanley and Washburn were planted May 29, June 11, June 16, respectively on recrop land. Average yield and (top variety) are in kg/ha. Minot - 1650 (Cenex 7101--2388); Stanley - 1664 (Sokota 2057--2153); Washburn - 1665 (Interstate 7111--2134). Thirteen triticale varieties were planted May 11 on fallow at Minot. The average and (top yielder) are as follows: 2308 kg/ha (Topo--2748).

Publications: 84/01 to 84/12

NO PUBLICATIONS REPORTED THIS PERIOD.

07.025 CRIS0029971 PRODUCTION OF SUNFLOWER, DRY BEANS, MINOR AND NEW CROPS IN NORTH DAKOTA

SCHNEITER A A; Agronomy; North Dakota State
University, Fargo, NORTH DAKOTA 58105.
Proj. No.: ND03610 Project Type: STATE
Agency ID: SAES Period: 01 OCT 84 to 30 SEP 89

Objectives: To evaluate crop production methods and physiological aspects of sunflowers, dry beans, miscellaneous and new crops in North Dakota. Crops to be evaluated in this project include sunflower, dry beans, mustard, rapeseed, safflower, buckwheat and proso millet. These data are used to make recommendations to farmers on crop production practices. New crops for North Dakota will also be evaluated.

Approach: Crops and varieties within each crop are compared under different environmental conditions and situations. Observations of agronomic characteristics and the responses of various crops will be recorded and reported. New crops will be evaluated to determine their potential for production in North Dakota.

Progress: 84/01 to 84/12. Variety trials were conducted at Fargo in proso millet, yellow and oriental mustard, polish and argentine rapeseed, grain sorghum, buckwheat, crambe, safflower, and garbanzo bean. A study evaluating the agronomic performance of normal height and semidwarf sunflower to varying plant populations was continued. The agronomic response of both plant types to all variables including plant population was similar. As a result, crop production practices recommended will probably not need to be altered for the two plant types. A model predicting

phenological development of sunflower hybrids and their inbred parents was developed. The model is based on temperature and is applicable only to those situations where the photoperiod at emergence is between 14.5 16 hours. This range encompasses almost all sunflower production areas in the continental United States, including the principal commercial production areas in the northern plains and hybrid seed production in California. Sunflower genotypes with day neutral, long day, short day and ambiphotoperiodic photoperiod responses were identified. A two year field study evaluating granular and seedcoat applied *Rhizobium phaseoli* was completed. No response in yield was observed. Nodak, an early maturing, high yielding pinto bean, previously tested as GH370 was released.

Publications: 84/01 to 84/12

ANFINRUD, M.N. and SCHNEITER, A.A. 1984.

Relationship of sunflower germination and vigor test to field performance. *Crop Sci.* 24:341-344.

SCHNEITER, A.A., MAJID, H. and JOHNSON, B.L.

1984. Comparison of normal height and semidwarf sunflower. National Sunflower Assoc. Sunflower Research Workshop, Feb. 1, Bismarck, ND.

SCHNEITER, A.A., GRAFTON, K.F., BURKE, D.W.

and WEISER, G.C. 1984. Nodak, an early maturing pinto bean cultivar. *ND Farm Research* 42(2):26.

SCHNEITER, A.A., MAJID, H. and JOHNSON, B.L.

1984. Agronomic performance of semidwarf sunflower. *Agron. Abstr.* Nov. 25-30, Las Vegas, NV.

FETCH, T.G. 1984. Laboratory evaluation of

seed-seedling vigor in sunflower (*Helianthus annuus* L.) M.S. Thesis, North Dakota State Univ., Fargo, ND.

07.026

CRIS0067837

OILSEED AND SPECIALTY CROPS

RIVELAND N R; FRENCH E W; Williston Agric Expt Station, Williston, **NORTH DAKOTA** 58801.

Proj. No.: NDO6382 Project Type: STATE

Agency ID: SAES Period: 01 JUL 75 to 30 SEP 85

Objectives: To evaluate the performance, adaptability, and potential for oilseed and specialty crops in Western North Dakota.

Approach: The crops will be grown at the Station in nursery and/or demonstration plots and agronomic data and plant disease information will be collected.

Progress: 84/01 to 84/12. Fifty-six oil type sunflowers hybrids were evaluated on fallow. Cargill 208 yielded 815 kg/ha and was the highest yielding hybrid. Interstate 3170 and 2 bird resistant hybrids developed at NDSU yielded less than 408 kg/ha. Stem weevil infestation was heavy and caused severe lodging. Seed oil content ranged from 40.7% to 53.1% with an average of 46.6%. Seven non-oil type hybrids were tested. Average yields were 755 kg/ha. Agway Royal Hybrid 2141 yielded the most at 821 kg/ha. Lodging caused by heavy stem weevil infestations was not as great as

compared to the oil type hybrids. None of the non-oil sunflower hybrids had sufficient seed size to qualify in the confectionary market. Only 22 days were needed this year to reduce seed moisture of 81.5% at full petal drop to 40% moisture. Flax yields averaged 766 kg/ha with Clark again the highest yielding variety at 891 kg/ha. Linton, a 1985 release from North Dakota, yielded 825 kg/ha and was tested as CI 2934. Rape varieties (*Brassica napus* and *Brassica comperstus*) yielded less than 350 kg/ha because of heat stress and blister beetles infestation. *B. alba* varieties yielded between 300 and 400 kg/ha while *B. juncea* varieties yielded 500 to 800 kg/ha. Soybeans were destroyed by deer. Holberg and Nodak pinto beans yielded more than 550 kg/ha while black turtle and navy bean yields ranged from 200 to 400 kg/ha. Red Mexican beans yielded 660 kg/ha and were the highest yielding dry beans.

Publications: 84/01 to 84/12

NO PUBLICATIONS REPORTED THIS PERIOD.

07.027

CRIS0013894

THE ADAPTATION OF CROP VARIETIES TO THE CENTRAL OREGON ENVIRONMENT

CROWE F; Agricultural Exper. Station; Central Oregon Expt Station, Redmond, **OREGON** 97756.

Proj. No.: ORE00828 Project Type: STATE

Agency ID: SAES Period: 01 JUL 66 to 30 JUN 86

Objectives: Selection, early testing, & increase of potato lines for statewide testing. Evaluate adaptability of new varieties of winter & spring wheat, winter & spring barley, oats, alfalfa, grasses for forage, sunflower & rapeseed.

Approach: A relatively large number of potato seeding tubers will be brought into Oregon from the several federal & state breeding programs. Tubers will be selected early for adaptation to long & short season conditions in Oregon & as soon as plant material is available tested for plant & tuber desirability, specific gravity, reducing sugars, internal defect & keeping quality. Selection process will proceed simultaneously with seed increase & lines tested throughout state as soon as possible. Other potentially new crop varieties from state, tri-state, and regional nurseries will be evaluated by standard techniques for adaptation in Central Oregon.

Progress: 84/01 to 84/12. CEREAL GRAINS. Variety trials were conducted at Powell Butte and Madras. Headrows of selection OWW72339 were grown for possible release. Selection OWW72339 showed excellent yield potential but is susceptible to Septoria. Winter wheat is often planted in early spring in Central Oregon. A date of seeding trail indicated "Stephens" had a lower vernalization requirement than "Daws". Variety "Hill 81" should not be planted in the spring. Spring barley "Gustoe" yielded well, had excellent test weight, relatively short straw, and did not lodge. ALFALFA. At Madras, "DeKalb 120" "Trumpetor", "Pacer" and "Vernema" yielded better than "Vernal". At Powell Butte (severe winters), no varieties yielded

significantly (5%) better than "vernal".
POTATOES. A statewide variety trail was planted at Powell Butte. Selection A74212-1 yielded well at all statewide locations. Internal quality was excellent, specific gravity was lower and it fried darker than "Russet Burbank". It had a moderate tendency toward black spot. Selection A079492-2 also yielded well at all locations; internal quality was similar to A74212-1. Over 30,000 selections were evaluated for yield, appearance, specific gravity and fry color.
FABABEANS. Variety trials were planted at Madras and Powell Butte. Yields averaged 2855 lbs/A at Powell Butte and 2244 lbs/A at Madras. Seedling plants withstood temperatures as low as 20 deg. F.
LENTILS. A lentil variety trails was planted at Madras; yields averaged 1108 lbs/A.

Publications: 84/01 to 84/12

- JAMES, S.R. 1984. Central Oregon Alfalfa Variety Evaluation Study. Jefferson County Extension Newsletter. Vol. 1, No. 11.
 JAMES, S.R. 1984. Varietal Evaluation of Cereal Grains in Central Oregon. Wheat Research Project Report, 1983-1984.
 JAMES, S.R. 1984. Using the Information from Variety Trials. Oregonmer-Stockman. May 3, 1984.
 JAMES, S.R. 1984. Evaluating Variety Trial Information. Proceedings Tenth Annual Oregon Hay Growers Association Hay and Forage Conference. February 15-17, 1984.
 JAMES, S.R. 1984. Central Oregon Alfalfa Evaluation Study. Irrigated Crops Research in Central Oregon. Special Report 717.

07.028* CRIS0013887
THE INTRODUCTION, AGRONOMIC EVALUATION & IMPROVEMENT OF POTENTIAL NEW CROPS FOR OREGON

JOLLIFF G D; Agronomic Crop Science; Oregon State University, Corvallis, OREGON 97331.
 Proj. No.: DRE00481 Project Type: HATCH
 Agency ID: CSRS Period: 01 MAY 60 to 30 JUN 86

Objectives: Find, evaluate and develop new agronomic crops for Oregon.

Approach: Field, greenhouse and laboratory experiments will be conducted to accomplish the above objectives. Selected accessions screened by USDA will be evaluated for adaptation and agronomic features. Promising species will be studied for development of cultural practices, selection of superior plants, physiological characteristics and breeding to improve yields and product quality in accord with needs for commercial development.

Progress: 84/01 to 84/12. Low night temperatures during the growing season were found to severely limit seed yield of indeterminate field-grown soybeans. It appears that dry matter is partitioned to vegetative growth at the expense of seed yield. An initial effort was made to locate germplasm with tolerance to low night temperatures. It appears that tolerance is available in soybeans developing by Holmberg in Sweden. Interspecific hybridization of *Limnathes floccosa* ssp. *grandiflora* x *L. alba* ssp. *alba* was

accomplished for the purpose of developing a self-pollinating *L. alba* plant type for agronomic production. This has led to the development of a population of hybrid materials; however, methods of progeny evaluation need to be developed. Agronomic studies were initiated with one selection of *Cuphea wrightii*.

Publications: 84/01 to 84/12

- JOLLIFF, G.D., CALHOUN, W. and CRANE, J.M. 1984. Development of a self-pollinated meadow-foam from interspecific hybridization. *Crop Sci.* 24:369-370.
 SEDDIGH, M. and JOLLIFF, G.D. 1984. Effects of night temperature on dry matter partitioning and seed growth of indeterminate field-grown soybean. *Crop Sci.* 24:704-710.
 SEDDIGH, M., and JOLLIFF, G.D. 1984. Night temperature effects on morphology, phenology, yield, and yield components of indeterminate field-grown soybean. *Agron. J.* 76:824-828.
 SEDDIGH, M. and JOLLIFF, G.D. 1984. Physiological responses of field-grown soybean leaves to increased reproductive load induced by elevated night temperatures. *Crop Sci.* 24:952-957.
 JOLLIFF, G.D., WHEELER, C. and CRANE, J.M. 1984. "Mermaid" meadowfoam (*Limnathes alba*) variety acceptance request. Oregon Agricultural Experiment Station. Corvallis, Oregon. 4 pp.

07.029

CRIS0079803

DEVELOPMENT OF OILSEEDS AS ALTERNATE CROPS FOR THE PACIFIC NORTHWEST

HANG A N; EVANS D W; ULLRICH S E; Agronomy & Soils; Washington State University, Prosser, WASHINGTON 99350.
 Proj. No.: WNP00481 Project Type: STATE
 Agency ID: SAES Period: 01 JUN 79 to 30 JUN 87

Objectives: Seek alternative crops for central and eastern Washington thereby broadening the agricultural base and possibly opening new markets; obtain basic agronomic and physiological information on promising alternate crops in order to make immediate cultural recommendations and to assess potential limitations which may be amenable to change; and Investigate crop combinations which utilize the growing seasons to the fullest extent.

Approach: Trials of cultivars of rapeseed, safflower and other oilseed crops under the same ecological conditions will be established. Pest control and other cultural practices will be standard for all experimental plots. Soil moisture will be kept at optimum levels for plant growth. Nutrient requirements of oilseed crops will be established by applying three levels of nitrogen and 2 levels of phosphorus. Effects of planting dates and seeding rates on yields, seed composition and dry matter accumulation will be determined by comparing 3 dates of planting and 3 rates of seedling.

Progress: 83/01 to 83/12. Trials of 14 cvs. of winter rape including the testing lines from W. Weibull, Sweden, were conducted in Prosser. Cv Hercules was the leading cv in terms of yield and test weight. Cvs WW-889 and WW-Emil were lowest in yield. Seed yield ranged from 1280-2890 kg/ha. This is low in comparison with 1982 when the weather was more favorable to seed yield than in 1983. Forty-eight cvs of spring rape were also tested. Yields ranged from 760-2820 kg/ha. Among these cvs Olga was the leader in both yield and test weight. Two cvs of safflower were planted for an irrigation study. Seed yield of S-208 and S-541 were increased with irrigation up to 25 cm of water applied. Oil content was not significantly changed with irrigation. Corn cvs are evaluated yearly in the central basin (1), lower Yakima Valley (2), and slopes facing the Columbia river at the southern WA boundary (3). Thirty cvs have averaged 92, 84 and 93 days from planting to 80% tassel and 168, 160 and 164 days from planting to black layer for the respective sites in 1983. Site-to-site correlations were $r(12)=0.893$, $r(13)=0.905$ and $r(23)=0.892$ for days to tassel; $r(12)=0.884$, $r(13)=0.837$ and $r(23)=0.829$ for days to black layer. Results from the yield and quality response of hops to water stress study showed that none of the hop cvs produced any stress symptoms and cone yields were not significantly different among the treatments. Cvs L1 yielded from 2650-2890 kg/ha while Cascade varied from 2310-2600 kg/ha.

Publications: 83/01 to 83/12

- HANG, A.N. and MILLER, D.E. 1983. Wheat development as affected by deficit, high frequency sprinkler irrigation. *Agron. J.* 75(2):234-239.
- SOMERS, D.A., ULLRICH, S.E. and RAMSAY, M.F. 1983. Sunflower germination under simulated drought stress. *Agron. J.* 75(3):570-571.
- EVANS, D.W., ADRIANSYAH, MAGUIRE, J.D. and CLINE, T.A. Grain corn evaluation, 1982. Wash. State Univ. Agric. Res. Ctr. Res. Bull. XB 0935.

07.030 CRIS0090985
ALTERNATE AND SPECIALTY CROPS FOR WASHINGTON

HANG A N; HEINEMANN W W; BEZDICEK D F;
Agronomy & Soils; Washington State University,
Prosser, WASHINGTON 99350.
Proj. No.: WNPO0481 Project Type: HATCH
Agency ID: CSRS Period: 06 JUL 82 to 30 JUN 87

Objectives: Seek alternative and pulse crops for central Washington, thereby broadening the agricultural base and possibly open new markets. Develop guidelines for cultural practices and irrigation management that are suitable for use on basic agronomic and physiological studies and for commercial production. Determine which crop combinations and or sequences will be economically sound for WA growers. Evaluate effects of limited irrigation and N fertilization on yield and quality of oilseed, pulse crops and hops. Evaluate nutritional value of oilseed meal, pulse crop meal and by-products of other alternate crops for livestock and cattle.

Approach: Trials of cultivars of fababean under irrigation will be established. Pest control and other cultural practices will be standard for all experimental plots. Herbicide and fertilizer trials will be conducted for all potential crops. Deficit irrigation on safflower, fababean and trickle irrigation in combination with N application on hop yield and quality will be established. Quality and nutritional value of oilseed by-products and fababean meals as animal feeds will be determined.

Progress: 84/01 to 84/12. Trials of 39 cvs. of spring rapeseed including the testing lines from W. Weibull, Sweden and Saskatoon, Canada were conducted in Prosser. Cvs. Hanna, Altex and Tobin were the leading cvs in terms of yield. BS136, 132-685, 25-668, WW-1375, WW-1383, BS 15 and BS-124 yielded as well as the above commercial cvs. Rapeseed yields ranged from 1950-3740 kg/ha (8% MC). This was a favorable year for spring rapeseed when some plots produced more than 4500 kg/ha. Coated rapeseed was also tested in Prosser. Coating material (clay, fungicide and several micronutrients) increased germination rate of all cvs. except cv. Tobin. Yield of coated Westar was 670 kg/ha higher than uncoated Westar. Crambe F(7) breeding line was also tested in comparison with cvs. Meyer, Prophet and Indy. There were 3 lines which yielded as well as Indy and Prophet (2200-2400 kg/ha). Cv. Meyer yielded very low this year (1840 kg/ha). Results from the yield and quality response of hops to plant water stress and nitrogen application showed that none of the hop cvs. produced any stress symptoms and cone yields were not significantly different among irrigation treatments. Avg. yield for Galena was 2490 kg/ha and was the leading cultivar for 1984. Eroica and Cascade yielded 2300 and 2060 kg/ha respectively. All 3 cvs. responded to N application up to 112 kg/ha. High alpha acid concentration was obtained from plots receiving lowest N rate.

Publications: 84/01 to 84/12

- HANG, A.N. and GILLILAND, G.C. 1984. Planting date effects on yield and quality of oilseed Brassica spp. Wash. State Univ. Res. Bull. 0924.
- GILLILAND, G.C., HANG, A.N. and PIKE, K.S. 1984. Rapeseed trial in Washington. Central Wash. Irrig. Crops Newsletter, WSU-IAREC, February 1984:5-6.
- HANG, A.N. and MILLER, D.W. 1984. Yield and physiological responses of potatoes to deficit high frequency sprinkler irrigation. *aGron. Abstr.* 76:106.
- EVANS, D.W. and CLINE, T.A. 1984. Grain corn yields - Irrigated trials of 1983. Central Wash. Irrig. Crops Newsletter, WSU-IAREC, February 1984:3-4.

COM 08 CHINESE TALLOW TREE, LESQUERELLA, STOKES ASTER, VERNONIA

08.001* CRIS0049443
GERMPLASM DEVELOPMENT AND DOMESTICATION OF
CUPHEA AND OTHER NEW CROP SPECIES

THOMPSON A E; Arid Zone Crop Prod Res U. S.
Water Conservation Lab; Agricultural Research
Service, Phoenix, ARIZONA 85040.
Proj. No.: 5422-20160-004-00D

Project Type: INHOUSE
Agency ID: ARS Period: 01 OCT 84 to 30 SEP 89

Objectives: Evaluate and develop improved
germplasm and achieve domestication of Cuphea
species as new oilseed crop serving as domestic
source of lauric acid and other medium chain
triglycerides. Evaluate Lesquerella species
and other taxa for possibility of developing new
crops for arid lands.

Approach: Assemble, multiply, maintain working
germplasm collection of Cuphea, Lesquerella,
and other potentially useful species. Evaluate
germplasm for agronomic characters, mode of
reproduction, seed yield and quality, and
adaptation to arid climatic conditions.
Determine intra- and interspecific breeding and
genetic behavior. Utilize existing or develop
new breeding and selection methodology to
obtain rapid genetic advance and develop
improved, adapted germplasm capable of
commercial production. Cooperate in joint
Federal-State-Industry funded multi-
disciplinary research at Oregon State AES to
develop Cuphea as a new domestic crop.

08.002* CRIS0044718
ISOLATION AND IDENTIFICATION OF ALLELOCHEMICALS
FROM UNCULTIVATED PLANTS

KLEIMAN R; SPENCER G F; WOLF R B; Northern
Regional Res Center, Peoria, ILLINOIS 61604.
Proj. No.: 3620-20160-009-00D

Project Type: INHOUSE
Agency ID: ARS Period: 02 OCT 78 to 16 APR 87

Objectives: Detection and identification of
phytochemical agents potentially useful in weed
control and plant growth regulation.

Approach: Screen for useful biological activity
such as bioregulation in extracts from seed and
other plant parts. Activity will be measured by
relative germination rates of selected weed
seeds. Active principles will be isolated and
characterized by chromatographic and
spectroscopic means.

Progress: 83/01 to 83/12. The biological
screening of extracts from seed of 225 wild
species revealed germination inhibitors in 21
of them. Selections from this group will be
made for isolation and characterization of
active compounds. Benzyl isothiocyanate, an
active germination inhibitor of velvetleaf seed
at the 4×10^{-4} M level did not affect corn
even at moderately high concentrations such as
 10^{-3} M but did affect soybean at the 10^{-4} M
level. Soybeans were not affected at the 4×10^{-4} M
level. The acetone extract of defatted Iva
axillaris seeds was found to contain

germination inhibitors tomentosin and ilicic
acid. Other compounds, such as avivalin, had
growth inhibitory properties. This work also
resulted in the isolation a new sesquiterpene,
tentatively identified as the isovalerate ester
of ivaxillarin. Computer programs were written
and data entered in order to have searchable
files for future reference of germination
inhibition data. In cooperation with plant
breeders working in the new crop area, analyses
for oil, protein, and fatty acids of seed were
accomplished. Species included in this program
were rape, crambe, Sapium, Sebiferum, Cuphea,
and Vernonia.

Publications: 83/01 to 83/12

ABBOTT, T.P., JAMES, C., and PLATTNER, R.D.
1983. Products of wheat straw
biodegradation by Cyathus stercoreus. ACS
Symp. Ser. No. 214, Unconventional Sources
of Dietary fiber, I. Furda, ed., Chap. 19,
pp. 267-284.

AWL, R.A., FRANKEL, E.N., and TJARKS, L.W.
Cyclic fatty esters: Stereochemistry of
monounsaturated products from the
hydrogenation and reduction of
9-(6-propyl-3-cyclohexenyl)-8-nonenic acid
or ester. Chem. Phys. Lipid.

CARLSON, K.D., CUNNINGHAM, R.L., and HERMAN,
I.A. 1983. Sweet sorghum grown on
sludge-amended stripmine soil: A
preliminary look at yields, composition,
and ethanol production. Trans. 111. State
Acad. Sci. 76:111-122.

CULL, I.M. 1983. Midwest plants for potential
crops. Trans. 111. State Acad. Sci.
76:213-216.

GARCIA, W.J., CAVINS, J.F., INGLETT, G.E.,
HEAGLE, A.S., and KWOLEK, W.F. 1983.
Quality of corn grain from plants exposed
to chronic levels of ozone. Cereal Chem.
60(5):388-391.

08.003 CRIS0047063
DEVELOPMENT OF IMPROVED STRAINS OF STOKES ASTER
(STOKESIA LAEVIS)

CAMPBELL T A; Beltsville Agr Res Center,
Beltsville, MARYLAND 20705.
Proj. No.: 1208-20162-014-00D

Project Type: INHOUSE
Agency ID: ARS Period: 20 APR 81 to 01 APR 85

Objectives: Stokes aster is a potential source
of epoxy acid for the chemical industry and
protein for food or feed. Specific objectives
of this research are to develop strains of
Stokes aster with improved seedling vigor and
seed retention as well as high epoxy acid and
protein content; to develop efficacious
management procedures for the improved strains;
to develop improved vernalization procedures
which will reduce the time from seeding to
flower production in the greenhouse.

Approach: Achenes from broad-based populations
will be screened in the growth chamber for
non-dormancy and seedling vigor. Selections
will be transplanted to the field where they
will be evaluated for vigor, seed retention,
and yield. Achenes from those plants selected
in the field will be evaluated for oil,

vernolic acid, and protein content and superior plants from each population will be intercrossed, within populations, in the greenhouse. This breeding procedure will be repeated until strains which are agronomically and chemically suitable are developed, then management studies (including herbicide evaluation, plant population and date of seeding) will be conducted. Experiments designed to develop means of shortening the time from seeding to flowering will be conducted. Treatments will be various light and temperature regimes as well as various levels of gibberellins and kinitin.

Progress: 81/01 to 85/04. Hydration chilling studies indicate that Stokes aster could tolerate early spring or early fall seeding. Equilibration at 15% moisture would reduce hydration chilling damage. Once germinated, tolerance to chilling in achenes would probably increase. Measurements of fluorescence and delayed light emission indicate that while prolonged chilling can cause some damage to Stokes aster leaves, mature plants are moderately chilling tolerant. Recurrent selection for seedling vigor in the growth chamber resulted in an increased rate of emergence in the field and a better final stand. Studies indicate that vernalization is often mandatory for flower induction and that Stokes aster is essentially cross-pollinated. A preliminary greenhouse herbicide evaluation indicated possible sensitivity to alachlor, naptalam, propachlor, chlorbromuron, linuron, and prometryne.

Publications: 81/01 to 85/04

- ABBOTT, J.A. and CAMPBELL, T.A. 1984. Delayed light emission and fluorescence responses to chilling in Stokes aster. *Agron. Abstracts*:97.
- CAMPBELL, T.A. 1981. Agronomic potential of stokes aster. In: PRYDE, E.H., PRINCEN, L.H., and MUKHERJEE, K.D. (eds.) *New source of fats and oils*. Am. Oil Chem. Soc. 9:287-295. Am. Oil Chem. Soc., Champaign, Ill.
- CAMPBELL, T.A. 1982. Seedling responses of Stokes aster to low temperature. *Agron. Abstract*:93.
- CAMPBELL, T.A. 1984. Responses of stokes aster achenes to chilling. *J. Amer. Soc. Hort. Sci.* 109: 736-741.

08.004* CRIS0043827
IDENTIFICATION OF DISEASE RESISTANCE &
PATHOLOGICAL STUDIES ON HORTICULTURAL & OTHER
PLANT GERMPLASM

OBRIEN M J; Beltsville Agr Res Center,
Beltsville, MARYLAND 20705.
Proj. No.: 1208-20162-009-00D

Project Type: INHOUSE

Agency ID: ARS Period: 25 MAY 77 to 31 MAY 85

Objectives: Identify and document resistances and obtain information on mode of disease transmission, host-pathogen interactions, and other important factors for specific disease organisms on selected plant germplasm of stokes aster, cruciferae, and carrots.

Approach: Develop suitable infectivity techniques to evaluate selected germplasm for resistance to specific disease organisms. Study the developmental morphology of the organisms, determine their infection-requirement parameters, explore their existing genetic stability or their potential mutability, and evaluate host-parasite relationship. Develop cultural methods and media to encourage sexual or alternate-stage development of the organisms. Verify and correlate results of seedling and mature-plant reactions to infection under field or greenhouse conditions.

Progress: 77/02 to 84/10. A strain of *Bacillus subtilis* controlled charcoal rot in vitro and reduced disease incidence in the field, providing a control agent that is effective, inexpensive, and non-hazardous to health. *Diaporthe melonis* sp. nov. was described on market cantaloupes, demonstrating that the imperfect state, *Phomopsis* sp., can occur on cantaloupe fruits and cause destructive soft rot. This research provides a means to identify the disease and an inoculation procedure to evaluate cvs and/or wild P.I.'s for soft-rot resistance. Six P.I. lines had moderate resistance/tolerance to *Fusarium oxysporum* f. sp. *spinaciae* in greenhouse tests of 205 P.I.'s and 19 cvs. P.I. 174384 survived tank tests at 20, 28, and 32 C; it possesses compact growth habit and is a slow bolter. The *Fusarium* wilt organism was isolated from the embryos of seed from inoculated spinach plants, demonstrating that it can be introduced during seeding into spinach-growing fields. Likewise, *Alternaria brassicicola* was recovered from embryos of seed from field-grown *Crambe* spp. with like premise of field contamination. In evaluation of 473 P.I.'s of *Solanum melongena* for resistance to *Verticillium dahliae*, three showed resistance; two had tolerance. The first report of the occurrence in the U.S. of *Phyllosticta cryptomeria* was made. A genetic-variation study assessed the resistance of 16 cvs and P.I.'s of *Hibiscus cannabinus* to *Botrytis cinerea*; three lines possessed field resistance.

Publications: 77/02 to 84/10

- CAMPBELL, T.A. and O'BRIEN, M.J. 1981. Differential response of kenaf to gray mold. *Crop Sci.* 21:88-90.
- O'BRIEN, M.J. 1983. Evaluation of eggplant accessions and cultivars for resistance to *Verticillium* wilt. *Plant Dis.* 67:763-764.

08.005* CRIS0092535
INTRODUCTION AND EVALUATION OF POTENTIAL
ALTERNATIVE CROPS FOR NEW MEXICO AGRICULTURE

LESSMAN K J; Crop & Soil Sciences; New Mexico
State University, Las Cruces, NEW MEXICO
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Proj. No.: NM-1-5-27432 Project Type: HATCH
Agency ID: CSRS Period: 01 MAR 84 to 30 SEP 88

Objectives: To introduce potential new field crops which will produce useful products particularly for industrial applications; To evaluate the breeding potential of introduced new crop species; To breed for improved

cultivars of introduced species after evaluation of breeding potential and determine the feasibility of *Crambe* spp. x *Brassica* spp. crosses.

Approach: Initial field and laboratory evaluations of *Brassica* spp., *Crambe* spp., *Lesquerella* spp., *Amaranthus* spp., *Chenopodium* spp., and *Salsola* spp. will be conducted over a three-year period. Characters studied for all materials will be seed germination, oil content, and glucosinolate content of seed meal will be studied for the *Cruciferae* spp. Heritability of all characters will be determined and expected gains from selection computed. Herbicides will be applied.

Progress: 84/01 to 84/12. Field evaluations of *Crambe abyssinica*, *Brassica* spp. (rape) *Amaranthus* sps. and *Curcubita* sp. (Buffalo gourd) were initiated during 1984. A replicated test nursery containing 100 *crambe* selections was seeded February 15. Data are being obtained for stand, seedling vigor, bloom time, height, yield, and oil production. Herbicides were applied to the *crambe* cultivar Meyer. The nursery area was essentially weed free and no damage was noted after dacthal (11.2 kgs/ha), treflan, and surflan (.5 kg/ha) were applied. The observation nursery containing *amaranthus* sps. showed shape considerable variation for inflorescence size shape color and grain yield. Selections for testing in 1985 were made. Of the eight *Brassica* lines evaluated, only four produced seed. Two populations 225,000 and 450,000 plants/ha of Buffalo gourd were seeded May 15 using two fertility levels in a split plot design with levels of fertility as the whole plot having five replicates. Data for gourd-seed and root-production will be obtained. Seeds and oil-free meal of *Crambe abyssinica*, seeds and ground seed of *Sinapsis alba*, seeds of *Brassica juncea* and seeds of *Brassica napus* were subjected to gamma irradiation (6.25, 12.5, 25.0 and 50.4 Mrad) to explore using irradiation to inactivate thioglucosidase and/or glucosinolate destruction. Exposure of 50.4 Mrad does inactivate thioglucosidase but has little affect on glucosinolates.

Publications: 84/01 to 84/12

- KNOWLES, P.F. and LESSMAN, K.J. 1984.
Development of new crops. CAST Rpt. 102.
- LESSMAN, K.J. and MCCASLIN, B. 1984.
Feasibility of using gamma irradiation to inactivate thioglucosidase from *Cruciferae*.
Los Alamos Biotech. Conference. Oct. 15.

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Central Oregon Expt Station, REDMOND
07.027

TEXAS

Texas A&M University, COLLEGE STATION
03.040, 03.046

Texas A&M University, EL PASO 03.042,
03.043, 03.044, 03.045, 03.047

Texas A&M University, PECOS 03.049, 03.050

Texas A&M University, UVALDE 03.041,
03.048

Agricultural Research Service, WESLACO
03.038, 03.039

THAILAND

Kasetsart University, BANGKOK 01.012

WASHINGTON

Washington State University, PROSSER
07.029, 07.030

WISCONSIN

University of Wisconsin, MADISON 05.013



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